Electrical Review

VOL. 77—No. 15. CHICAGO, OCTOBER 9, 1920. PAGE 549.

Pictorial Review of Steps in Development of Artificial Illumination.

The Developments in Artificial Illumination

Various Steps in Use and Application of Types of Lighting Devices — Processes and Details in the Manufacture of Modern Incadescent Lamps — Magnitude and Influence of the Industry

By C. D. WAGONER

Publicity Department, General Electric Co., Schenectady, N. Y.

Man has long pitted his ingenuity against the night, and now he seems to be on the road to triumph. The wavering yellow flare of the prehistoric cave fire, the antiquated candle and many other forms of illumination have been relegated to the past by the comparatively recent development of the electric incandescent lamp. Slowly this promotion of earthly illumination is becoming universal. The busy agent of the lighting industry is incessantly supplying new services until now more than four hundred million bulbs shine every night. The individual of the present lives in a glow that would astonish his forefathers. Today the man with a home is a wizard in his own house. And the twentieth century housewife finds her path brightened by a power so completely a part of her daily life that she no longer wonders at it.

The long period of conflict with nightly darkness seems to have ended in the supremacy of the new light, and the householder of today feels none of the depressing influences of the dark that shadowed the home of the primitive man whenever night closed down. Primitive man in his cave home in the rocks needed the protection of brilliant light more than any home today can need it, but it was not to be had. The best he could do was to keep a fire burning. Fire was supposed to be the gift of a god who brought it down to earth from the sun, and fire was the primitive man's only source of light. Naturally, he guarded it with the utmost pains.

Evolution of the torch was the great accomplishment of what might have been the first illumination research. Separating the central blaze into a number of smaller blazes, and carrying them about for local lighting, probably was the first move towards the developing of the torch idea and was a long step in advance of the single-fire light source. Slowly the early methods improved, resinous wood and pine splinters became the dominant torch materials, and the home builder devised means of fixing these torches into niches in the wall.

First Practical Incandescent Lamp Made in 1879.

The evolutionary process continued to the candle era. Romans and Phoenicians were the first real candle users of history, and the latter introduced candles into Constantinople during the fourth century. The candle, in turn, remained almost supreme throughout the middle ages and as late as the century just passed. It was unrivalled until petroleum-oil lamps created the beginning of a new step forward towards the brighter days of the modern home.

Changes in home lighting now came rapidly. The old-fashioned chimney lamp came into great popularity with the introduction of kerosene. Gas lighting quickly arose to compete with the oil lamps and was hailed as the wonderful new illuminant. Then Thomas A. Edison developed and made the first incandescent electric lamp, and the "white magic" of electric light commenced to take its place in the home. This was

in 1879—a year of note in the progress of events towards better illumination. In October of that year the first practical incandescent lamp was made. As finally put on the market these lamps used carbonized-bamboo strips for the light-giving filament. The first bulbs used for electric lamps had a tapering glass neck, but were expanded at the top into a globe. When lamps began to be made in quantity the bulbs were blown from moulds, thus becoming uniform in shape and size. Today the glass-blower's art is indispensable in providing the vast quantities of bulbs needed every year. They are made faster than a million a day.

Dim and short-lived, the early lamps were forerunners of today's illuminants. They consumed 100 watts of electricity and gave but a 16-candlepower ray, while the modern lamp gives about eight times the amount of light for the same energy consumption; and the cost of lighting in 1919 was only 3% of what it was in 1881. If the lamps now used were made to operate at the low efficiency of those first lamps, it would be a serious economic factor. The extra coal which would have been needed under such conditions during 1919, to produce the electric light used in this country alone, would have cost $500,000,000, or ten times the value of the lamps purchased that year in the United States.

Many Operations Required in Manufacture of Lamps.

Consider that the many incandescent lamps, now met with on every hand are created by a myriad of operations; consider also that a great organization of people works busily from day to day to enable mankind to command the comfort and convenience of good illumination. Every individual in that organization is a magic worker, but few of them realize it. Their occupations are robbed of romance for them because they cannot see or understand the many wonderful results of their work. Many of them work on believing themselves engaged only in drudgery and feeling themselves deadened by monotony while working for the comfort of others.

There are miners in this organization, with their picks and shovels, there are clay mixers whose only part in the work is to heap up mounds of earth substance, and there are machines that seem almost as versatile as the men who run them. There are glass blowers who fashion clear, delicate bulbs, and girls who put many parts of the lamp socket together and hold them while automatic screw drivers tighten the fastenings. Scientists, who work with patience to make each part still more perfect, contribute their share to the many remaining problems of production and development. It took years, from the time of the first crude filament, for research laboratories to discover the true basic principles of light generation and apply them to obtain the commercial lamps of today. The core and center of the modern lamp is a curious mineral element known as tungsten. It is now the best substance available to put into an electric-light bulb for illumination. When tungsten is taken from the earth it is more or less hidden in certain ores called "Steelite" or "Wolframite." By vari-

View in the Glass-Blowing Section of the Research Laboratory of General Electric Co., Schenectady, N. Y.

ous chemical and mechanical treatments hard fine tungsten powder is secured from the crude ores. From the powder stage the tungsten, by many intricate processes, is drawn into wire form. It becomes, at last, the finest of hair-like wires and is placed within the lamp bulb

Tungsten Wire Made Ductile for Use in Lamps.

For years no ways were known of making tungsten ductile so that it could be drawn into wire. Experiments were tried abroad but failed. Other experiments were undertaken in this country, and American scientific ingenuity finally solved the problem. The solution was worked out in the research laboratories of the General Electric Co. at Schenectady, when Dr. W. D. Coolidge discovered a method of accomplishing the production of tungsten wire. It made the manufacture of lamps a reality. A few years later another remarkable discovery took place in the same laboratories. This time it was the evolution of the gas-filled lamp, developed by Dr. Irving Langmuir of the laboratory staff. In this process the bulb is filled with inert gases. These inert gases—argon and nitrogen—have added greatly to the brightness of the lamps until the largest size regularly made, a 1000-watt lamp, produces a light of nearly 2000 candlepower. From the research laboratory, with its tireless workers, has come the astonishing progress that today has finally supplanted primitive man's uncertain fire light with the steady, reliable, brilliant "white magic" of modern illumination. Chemists, physicists, metallurgists and engineers have there co-operated in a steady forward drive for scientific knowledge, and the achievements made have, broadly speaking, benefitted the whole human race. To the art of lighting alone, especially the lighting of the home, they have contributed great things. Electric lamps, both large and small, are now in use because of what these laboratories have done, and a vast electrical industry has been built up around and because of the success of the incandescent lamp.

From the substations of the electrical system, dotting the land in every direction, radiate millions of miles of slender wires carrying the current into more than six million homes. All-important in connecting the substation and incandescent lamp, they transmit the electricity which heats the sensitive tungsten and produces the visible effect of light. There is much interesting detail in the way this wire is constructed. In the beginning of the process it is a thick rod of copper which is annealed, or softened, in a superheated furnace. Then its transformation begins at the wire-drawing machines where it is reduced in size and finished. Smaller and smaller it is drawn, and all with the utmost of speed, going into the machine at the rate of a hundred feet a minute and coming out at ten times that figure. But it has shrunk in the process. Its diameter, after its passage through ten different dies, measures 0.064 in.—the size with which homes are wired. Insulation is applied by a machine like a mechanical "may-pole." Spools of thread revolving in wavy convolutions, unwinding as they go, wrap cotton or silk around the naked wire as it is drawn steadily through a hollow spindle,

Fashioning Porcelain Bases for Lamp Sockets.

and a reel takes up the finished wire ready for shipment and use.

Manufacture of Sockets Involves Many Processes.

The simple-looking socket which this wire feeds into is a more complicated device to manufacture. Men, women and machines are busied in producing it—its manufacture is an industry by itself, and it draws upon several sub-industries, especially for the making of porcelain insulation. Machines that operate continuously are employed in stamping metal caps out of sheets of brass, shaping them with dexterity, squeezing and cutting hard metal as if it were mere paper—all to produce screws, socket shells, socket caps and lamp nozzles.

Common laborers mix in proper parts great quantities of china clay, ball clay, flint and feldspar for the manufacture of porcelain. The formula by which the ingredients are blended is one of the secrets men have had to discover in the perfection of the lighting industry. Many elements of the great electric-lighting systems must have porcelain insulation. It goes into the switches, cutouts and fuses. And every lamp socket has a porcelain interior hidden out of sight beneath an outer shell of metal. However, porcelain is only a minor item in the producing of light. Yet at one of the large electrical manufacturing plants its production requires more than nine tons of mixed clay daily, and in a year's time 2800 tons of clay is consumed. In this one plant 800,000 porcelains are fashioned daily.

Only a few hours pass from the time the porcelain clay is mixed until, having been filtered

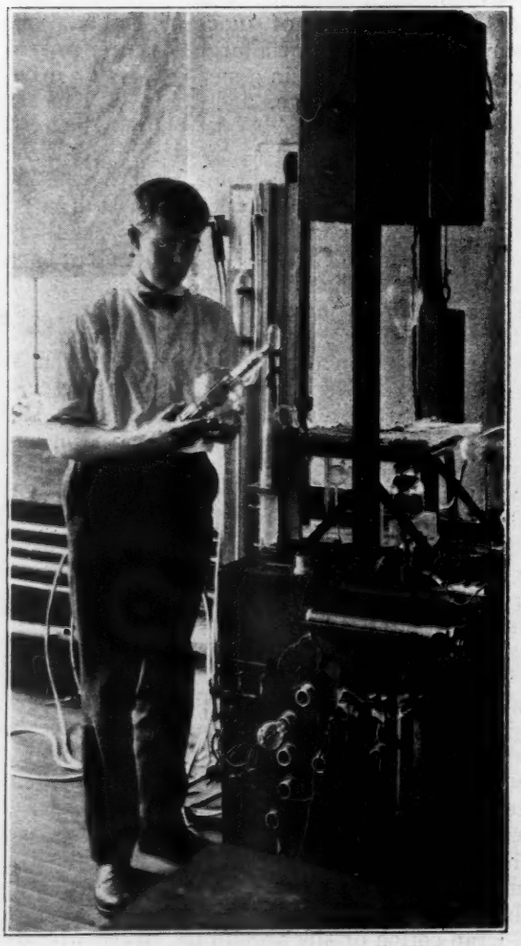
Preparing Metal Shells for Lamp Sockets.

and dried, it is crushed, pulverized and screened in one continuous operation; then the moulding machines shape it into patterns. Large firing kilns, into which the insulation pieces are stacked in hundreds, bake the clay until it is hard and durable and ready for insertion in the lamp socket. A total of 175,000 sockets are created every week, the huge total of nine million being reached within the span of a single year. And this is what takes place in but one building of a large factory. In all, 600 different kinds of sockets are turned out of a single plant where hundreds of operatives perform seemingly trivial functions. No less than 207 persons handle every separate socket, and 237 operations go into the making of each one. In this plant are produced enough sockets every day to add nearly 30,000 new lights, when joined with the lamp and connected with the wire, to the earth's illumination. This production is equal to the entire number of lamps made and sold during 1881 when the first commercial lamp came on the market.

Automatic Machines Used in Manufacture of Sockets.

Continuously operating machines enter into the production of parts. They stand in long rows and work incessantly from day to day, while the hoppers beneath them fill steadily with the manufactured parts. There are machines that clutch the socket caps and lift them aside at just the precise moment; other machines with tiny fingers pick out and divert to a wooden box all socket caps which are facing the wrong way as they proceed down the runway for the next operation. There are machines, too, which absorb large reels of wire and, by one operation, shape it into screw forms. Other machines cut the slot for the screw driver; still others give them a brightly shining polish, or roll them swiftly through the thread-cutting dies. This complication of processes and machines is multiplied through the assembling of the 20 to 40 parts of each socket. Electrical screw-drivers, saving millions of minutes, are included among the many and interesting devices employed.

All this is in the background of the lighting industry, and it all depends for its ultimate success on co-operation. Co-operation is something that the primitive man knew as little of as he did of electricity. He had his own fire for his own light and cared but little for what might befall his neighbor. But modern man is a co-operative individual, and by careful organization, study and planning has produced and perfected the array of details required to overcome darkness. Following are a few of the 237 operations involved in the production of a single lamp socket: Moulding base of porcelain insulation; punching screw shells from sheet copper; threading screw shells; punching bottom of screw shells; cleaning them in chemical fluid; punching socket caps; perforating socket caps; attaching nozzles to caps; drilling and tapping nozzles; punching socket shells; re-drawing socket shells to finished shape; trimming and threading socket shells; polishing socket shells; punching key slots; forming horseshoe contacts; making small screws; flattening key stems; assembling of socket (12 operations), and applying life test. From this brief list it may be seen that a vast amount of detail, organization and co-operation is required in the production of electric light.



View in Research Laboratory of General Electric Co., Schenectady, N. Y.

Lighting of Hospitals and Dental Offices—Part II.

Results of Investigation Show Lack of Adequate Lighting in Majority of Medical Institutions—Recommendations for Proper Equipment for Hospitals and Dental Offices and Laboratories

By A. L. POWELL and H. H. ALLISON
Edison Lamp Works, Harrison, N. J.

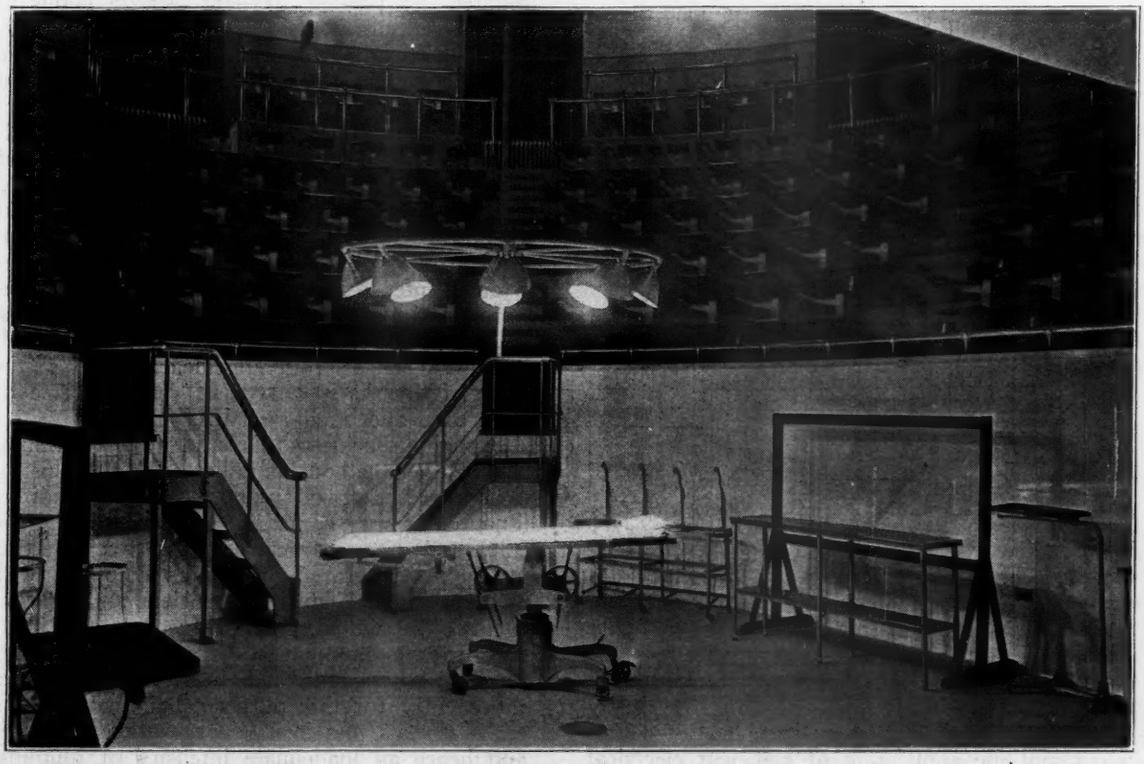
The lighting requirements discussed thus far do not differ materially from those ordinarily encountered. In the operating room, however, special demands exist as to lighting. There are two general types which require slightly different treatment in their lighting. The first is the type of room used in the city or private hospital, it being relatively small in size and containing merely the operating table, sterilizer and a few necessary pieces of apparatus. The second is the operating room of the hospital connected with some educational institution, and made in the form of an auditorium for the purpose of holding lectures or clinics accompanied by demonstrations. Walls and ceiling should be pure white; in the more modern hospitals they are constructed of tiling, and the floor is smooth white marble, for ease of cleaning and sanitation.

In the first type of room strong illumination is needed over the operating table with local lighting for the sterilizer and accessory appliances. There will, in general, be sufficient light reflected from these units to enable the surgeon and attendants to move about with facility.

In the auditorium type of operating room, the "pit" may be treated as just discussed, but general illumination must also be provided in the balcony to enable the class to take notes with ease. An intensity of 3 or 4 foot-candles is desirable here, and may be provided by use of wall brackets at the rear of the top tier of seats, supplemented by properly spaced ceiling units of standard types. Wall bracket or overhead units should also be provided for general illumination of the "pit," to be used when preparing for an operation and at other times when general illumination is necessary here.

The lighting equipment used in the operating room must have the general sanitary qualities necessary throughout a hospital.

The main question is that of lighting the operating table proper, and the requirements for both types of room are identical in this respect. In the auditorium type of operating room it is com-



Operating Amphitheater of Large Municipal Hospital Provided with Special Fixture Having Concentrating Reflectors and 60-Watt Lamps.

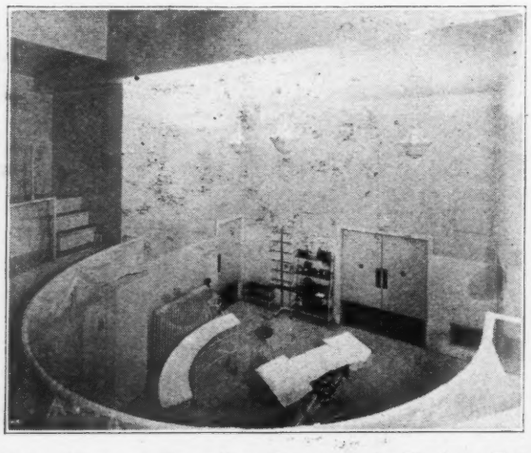
mon practice to conduct operations at night, making the demands for this class of buildings especially important. In the smaller institutions the majority of the operations are performed in the daytime, and it is only on special occasions that artificial light is called into play.

The operating table requires a high intensity of well-diffused light of the proper color coming from several directions. High intensity is required on account of the minute details which must be observed at all times. Diffusion is necessary to eliminate shadow effects. Light of approximate daylight color is desirable in order that the blue veins, red arteries or yellow bile ducts can be distinguished one from the other. It is also essential to have light coming from several directions in order to illuminate the interior of an incision properly. Many classes of work require light from nearly a horizontal direction for penetration.

The fixture itself must be of such construction that there is no danger of dirt accumulating and falling into the wound, and must be so placed as to minimize the possibility of this action. It should radiate the minimum amount of heat in order that the surgeon and attendants may work in comfort and without danger of perspiring.

The natural illumination of the operating room should be a subject of careful study, and to secure the best results the surgery is usually located on the north side of the top floor of the institution where minimum obstructions exist. Skylights with semi-diffusing glass constitute a part of the north wall and a considerable part of the ceiling. North light is generally well diffused and more uniform in quality and quantity than that from other points of the compass, and for this reason is preferred.

The surgeon endeavors to conduct the most important operations under daylight conditions,



Night View of Operating Room of Auditorium Type Lighted by the Indirect Method.

yet he realizes that in times of emergency dependence must be had on artificial illumination. Without giving the matter careful thought, many medical men would make the claim that it is impossible to secure thoroughly satisfactory artificial lighting. This statement may be justly combated with discretion in the choice of equipment and the application of sufficient electrical energy transformed into light, daylight effects can be readily simulated. The uninitiated might think that such a procedure was too costly to be practical. Such is not the case. Suppose, for example, it required a total of 3000 to 5000 watts to illuminate an operating room properly. (This is far more than necessary in most cases.) At the customary rates for electrical energy, this might cost from 25 to 50 cents an hour. The operating room is customarily charged for and it will be seen that this figure represents but 1 to 2% of the rental of the room. Certainly proper lighting is worth this percentage.

The old methods of operating-table lighting were indeed crude. One of the most common forms of fixtures consisted of a cluster of relatively small incandescent lamps arranged radially under a flat reflector. This fixture was glaring, and the light came from one general direction, making shadows dense. Sometimes these fixtures were equipped with diffusing glass screens, but at best this did not produce good results. In an attempt to eliminate many of the objections of this arrangement, an elaborate scheme was developed in Germany where a cluster of mirrors was grouped around a support, a searchlight placed outside of the room and a beam of light thrown through a lens system to the disc of mirrors and finally directed on the table. This scheme was used to some extent in Europe, but has not met with great favor in this country, since the mirrors require frequent cleaning and in cleaning get out of adjustment. Much simpler methods of obtaining the same results have since been developed, as indicated later.

With the constantly increasing efficiency of the incandescent lamp, methods of application which a few years ago would have been impractical on account of the high operating cost are now most feasible. For example, north skylight can be imitated by placing daylight Madza lamps in suitable reflectors outside of and above the skylight, illuminating the room with light of the same character, of the same general direction and with sufficient intensity. This method is actually used in some of the more modern buildings. It is true that there is a certain amount of absorption in transmission through the glass and that the construction work is rather costly, but the splendid results obtained justify such expenditures. For general illumination of this character an intensity of 30 to 50 foot-candles is desirable and would be attained by providing from 10 to 15 watts per sq. ft. of floor area, depending on the structural arrangement, density of the glass of the skylight, type of reflector, size of lamp used and similar details.

If such a scheme as this is not feasible, a number of other methods as indicated in the illustrations represent good practice. Totally indirect illumination may be used if the ceiling is light in color and of a character suitable for reflecting the light. Mirrored-glass units equipped with daylight Mazda lamps are efficient and produce evenly distributed, well-diffused (practically shadowless) illumination. Instances have been reported where indirect lighting has proven unsatisfactory for this purpose, but analysis generally reveals that insufficient wattage was used and hence an inadequate intensity of illumination secured. It must be borne in mind that work of the character carried on in the surgery

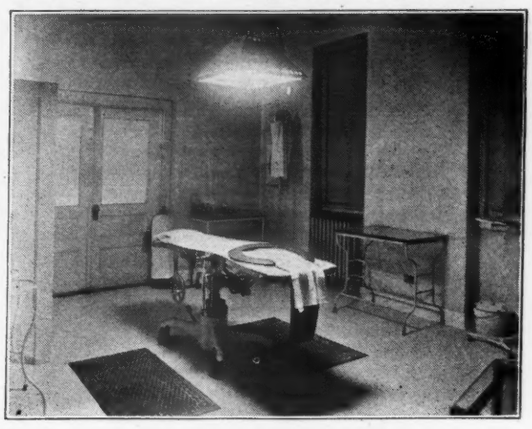
demands a high degree of illumination, and sufficient power must be used.

Where conditions preclude the application of the skylight method or general illumination by the indirect systems, special direct lighting fixtures are available. This consists of a pyramidal-shaped metallic hood suspended over the table and fitted with mirrored glass reflectors and type C lamps. The special equipment is provided with an outer and inner glass cover with a space between these and a ventilating arrangement for conducting the heat away from the table. Such a device provides diffused light of a high intensity from directly above the table. The large area of the source tends to eliminate shadows. Its advantages are its simplicity and compactness. A unit of this character is entirely adequate for the less exacting operations and maternity work. It is often necessary to supplement a unit of this type with a portable lamp stand and suitable reflector to direct light on vertical surfaces.

In the attempt to obtain light from a number of directions, as in the searchlight and mirror arrangement previously mentioned, another fixture has been developed. This is made of nickel-plated pipe, shaped like a large wheel and 8 ft. in diameter. Eight polished steel parabolic concentrating reflectors utilizing small lamps are equally spaced about the rim. The reflectors focus the light on a rather small spot, producing a high intensity. Since a multi-directional effect is secured, some of the desired objects are attained; the diffusion is not all that is to be desired and if the surgeon chances to glance upward there is a possibility of objectionable glare. Inasmuch as only a small area is illuminated to a high intensity, it is necessary to supplement a unit of this character with good general illumination in order that the nurses and assistants may have light to select instruments, bandages, thread needles, use sterilizers and perform their natural functions.

A modification of this scheme of lighting has its good features and overcomes most of its objections. In this arrangement 12 prismatic angle-type reflectors are mounted on a frame work or directly attached to the ceiling about 10 ft. above the floor. These are fitted with 75-watt bowl-enameled daylight Mazda lamps. A splendid distribution of light on the table from all directions is secured. The light is of a suitable quality, units are hung at a sufficient height so that the heat is not objectionable. The fixture construction is simple and reflectors are not located directly above the table, so that any dust which might have accumulated will not fall in the wound. Since the prismatic reflectors transmit a certain percentage of the light no general illumination is needed in addition. Measurements of the illumination produced by such a layout indicate intensities between 40 to 50 foot-candles on the horizontal plane, 20 to 30 foot-candles on the 45-deg. plane, and 10 to 20 foot-candles on vertical surfaces above the table.

The investigation referred to previously indicates that there is much to be desired in present practice. At least 90% of the operating rooms inspected were equipped with a single fixture over the operating table, with an inadequate reflector of a glaring type which gave an undesirable distribution of light for this sort of work. Only 8% of the hospitals were equipped with modern units, and only 7% of the total were properly provided with a sufficient number of



Diffusing Type of Operating-Table Fixture Equipped With Six 100-Watt Type C Lamps in Mirrored Reflectors.

receptacles for the attachment of local lights, instruments, anaesthetic apparatus and other essential appliances.

High Intensity of Light Required in Hospital Laboratories.

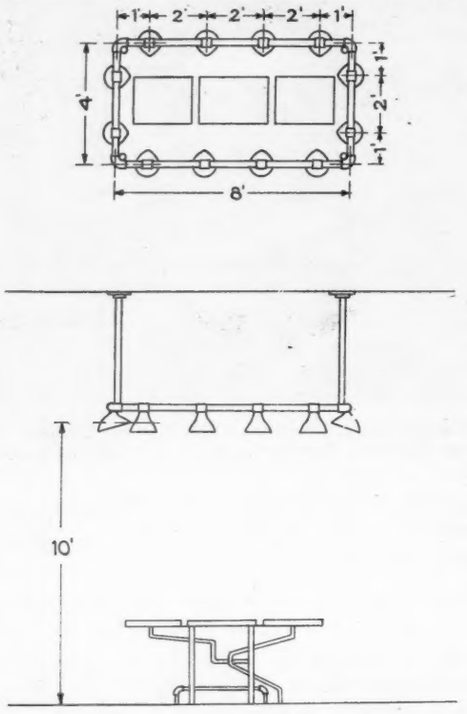
The nature of the hospital laboratory depends considerably upon the branch of medical practice to which the institution is devoted. Those confined to certain classes, as maternity or nose and throat work, have practically no demands for this part of the institution, while others, especially those used for skin and orthopedic diseases, use laboratories of considerable extent. Analytical work and bacteria culture experimentation is carried on, and the general lighting requirements are quite identical with those of the chemical laboratory. Evaporation, filtration, titration and like process naturally demand a reasonably high intensity (5 to 8 foot-candles) of general illumination in order that these steps may be carefully watched.

Local lighting of the benches around the walls where the major portion of the work is carried on should be supplemented by general illumination for the center of the room, where the ovens, refrigerating and sterilizing apparatus is located. As there is a possibility of a considerable amount of chemical fumes being present in the atmosphere, special attention must be paid to the choice of fixtures and equipment. Any metal work must be treated to prevent deterioration. Porcelain, rather than brass-shell, sockets are to be preferred.

One of the particular problems encountered is the artificial illumination of the microscopic field. There are a number of special devices for this purpose. Slides of a light character can be examined readily with well-diffused light of a moderate intensity. The opal-bulb, 50-watt white Mazda lamp giving such a character of light has been used to some extent for this purpose.

Much of the work, however, is on slides containing dark blood fields and the like. This requires a powerful source of illumination. Until

within the last few years the arc light has been used almost exclusively for this purpose. At best, this form of illuminant is annoying on account of its flicker and the necessity of constant adjustment of the carbons. Recent developments of type C lamps with concentrated filaments have



Angle-Type Prismatic Reflectors With 75-Watt Bowl-Enameled Lamps.

eliminated these difficulties. Such an illuminant gives a steady light of uniform quality. The small size of the light-emitting portion enables one to place it accurately at the focus of a lens system and obtain any concentration necessary. Frequently low-voltage lamps, which have somewhat more concentrated filaments than those designed for operation on the standard circuits, are used for this work. By applying correctly selected dense blue glass screens the color of the transmitted light can be readily modified to an exact north sky quality.

Good Arrangement of General Lighting Necessary in X-Ray Room.

The properties of the Roentgen rays or the apparatus used in their production are outside of the province of this article. On the other hand, suitable artificial illumination must be provided for illuminating the rooms in which X-ray machines are located. The old practice of using a few wall brackets or drop lights located rather indiscriminately about the room is not a condition to be desired. Fixtures hung low are objectionable, being in the way of wiring and control apparatus. Suitable diffusing direct lighting fixtures placed close to the ceiling to give even illumination of 3 to 5 foot-candles are preferable. Baseboard receptacles should be provided at convenient intervals around the room for portable lamps or auxiliary appliances which may be necessary.

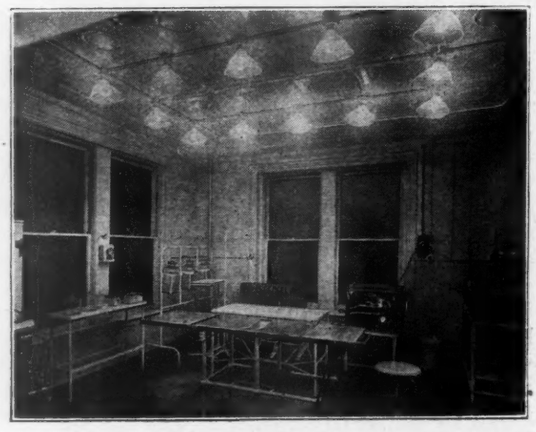
General lighting is also desirable in the fluoroscopic room, and the fixture should be so wired that the lamps are operated by a switch on the foot pedal which controls the X-ray apparatus. The small dimmer lamp should also be operated from this foot pedal. Some such arrangement as this is most essential in order that the person using the table may switch off, dim or turn on the lights without moving from the X-ray control.

After the X-ray negative is obtained it is necessary to examine it carefully. Considerable experimentation has been carried on to ascertain the best method of providing light for this purpose. Extremely well-diffused illumination of approximately daylight character has given the best results. It is a simple matter to construct a box or framework, the mouth of which is covered with diffusing glass. Daylight type C lamps in efficient reflectors are located behind the framework and their light directed on a flat white background. From here it is diffusely reflected to the opalescent glass plate and thence through the negative.

Signal Systems and Wiring for Lamps Are Important Factors.

The source of current supply in any public building must be dependable. This condition is particularly true in the hospital where the occupants are in a critical physical condition. The most exacting demands exist in the operating room, where the failure of illumination might have a fatal result.

Some of the large hospitals have their own generating plant, and the possibility of this being out of service should be anticipated and breakdown service from the central-station company installed. Many isolated plants are designed for a 220-volt system which is not desirable from the standpoint of lighting service. If direct current, 220 volts, is used, the three-wire system with three-wire generators or balancer sets



Night View of Operating Room of Industrial Clinic Illuminated by System Shown in Preceding Illustration.

proves a real economy. As to the choice of system, it must be borne in mind that alternating current is necessary for the X-ray apparatus, and, in case of a direct-current installation, a motor-generator set must be provided for this purpose.

Whether the hospital has its own plant or

whether the energy is supplied from a central station, the building should be so wired that the blowing of a fuse will not extinguish all of the lights in any section of the building. The circuits in wards and corridors, for example, should be so arranged that part of the lights are on one circuit and part on another. In some instances duplicate panel boards with emergency switching and plugging arrangements are installed to make possible a quick change-over.

An emergency system in the operating room is particularly important, so that even the failure of the entire electric supply will not throw the room into darkness. Gas as an auxiliary is at best a makeshift, for it is not likely that suitable equipment will be installed to give satisfactory illumination with gas. As ether is used as an anaesthetic, it is not particularly safe to have an open flame near the spot where this is being administered. A small storage battery of sufficient capacity to light the operating room for a given period of time is a most desirable feature. The mere throw of a switch in such an installation takes care of any emergency. The care required by a storage battery is not excessive, and most hospitals have a plant engineer who is thoroughly competent to maintain the battery. Small low-voltage batteries are also very useful for furnishing energy for miniature surgical lamps and microscope illumination.

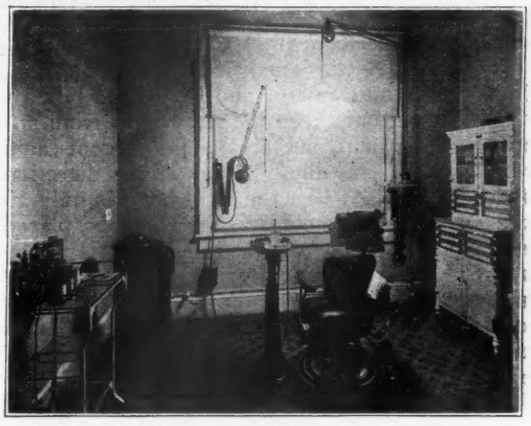
The signal system in the hospital—an important element—also employs the storage battery for its operation. The modern type of signal devices are noiseless and the old bell or buzzer for calling the nurse or attendant is a thing of the past. Two general methods are employed for the purpose, one utilizing a semaphore or small arm which drops from a vertical to horizontal position over the door or nurses' desk. The latest system has a push button by the patient's bed, which, when operated, lights a signal lamp over the nurse's desk and one by the bed, or outside of the door, in the case of a private room. When the signal lights, the nurse glances down the ward or corridor and locates the patient who requires attention. These lights are left burning until the nurse responds and extinguishes them by inserting a special key in the push-button switch. This system is not so unsightly and not as likely to get out of order as the semaphore or annunciator system.

Proper Methods of Lighting Dental Offices and Laboratories.

The waiting room of a dental office involves the same lighting requirements as the reception room of a hospital. The more attractive and soothing the lighting conditions are made, the more readily the patient will await his appointment. The methods of lighting outlined in the first part of this article apply here.

There are two systems in vogue for securing proper illumination in the office for the actual dental work; one supplies a high intensity of general illumination, enabling the dentist to work under conditions approximating natural lighting, and the other involves the use of only a small beam of light focused directly upon the mouth by some form of special illuminator or spot-lamp. As with any class of lighting, general illumination is more effective in most cases and offers wider possibilities.

It is obvious that the desirable results are secured with such a system no matter where the dentist is standing or working; neither he nor his instruments or mirror will cast shadows in the working point. The ideal light would reach every portion of the mouth, and, with the assistance of the mirror, illuminate the deepest recess. In order to minimize shadow effects, it is obvious that light must come from more than one direction, which necessitates the use of more than one light source or a unit having a large reflecting or diffusing surface. The semi-indirect and totally indirect fixtures which direct the major portion of the light to the ceiling produce such an effect. Since the details to be observed are extremely minute, high intensity is an essential element; the color of teeth must be compared and the condition of various tissues noted light approximating daylight is desirable.



Dental Office Illuminated by 300-Watt Daylight Lamp on an Adjustable Fixture.

Where structural considerations prevent or where the color of surroundings is such as to preclude such lighting, its effects can be simulated by the use of an adjustable diffusing fixture. Since the dentist usually works from the patient's right side, this outlet should be located to the front and slightly to the left. Where the fixture is adjustable, the swing of the supporting arm should be regulated for this position.

A fixture having the same general characteristics, although not quite as simple, utilizes four lamps in prismatic inclosing globes on a swinging arm fastened to the window casing. The simplicity of installation of these units is one of the great points in their favor. On the other hand, a certain amount of time is involved in adjusting the device to suit particular conditions which is not necessary with the overhead general lighting scheme.

The spot-lamp falls in the same class as the local lamp over the tool in the machine shop. It is inconvenient, and valuable time is wasted in adjusting it. Most machine-shop illumination can be secured much better from the high-intensity general method, yet there are a few special processes, such as the machining of the interior of deep castings, which make a local lamp a necessity. It is the same in the dental office. The greater proportion of the work can be more satis-

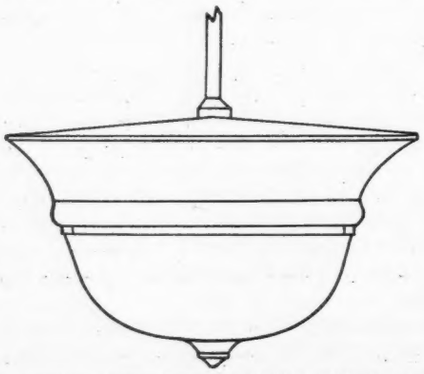
factorily performed with proper general lighting, yet for some very special conditions the mouth lamp is a valuable adjunct. Continuing the analogy, many forms of drop lamps in the industrial plant are practically useless and objectionable from the standpoint of glare. The dental lamp which employs a low-wattage unit with a half-shade reflector on a flexible or adjustable arm throws much light in the patient's eye, is cumbersome and if not specially constructed may soon become mechanically weak.

The carefully designed lens-type spot-lamp, illuminated mouth mirror and head-band type of equipment not only keep the stray light from annoying the patient, but are useful in root-canal work and for transillumination in the detection of dead teeth. At best the local lamp is only an accessory, and dependence should not be placed on it alone. Good general illumination is necessary to enable the operator to pick up readily any instrument on his stand or cabinet, for in the poorly lighted room the contrast between a brightly illuminated area and the dark surroundings is a source of much confusion to the eye.

In the dental laboratory, lathe polishing, gold and plaster work, soldering and plate finishing require a high intensity of illumination. Local lighting above the bench employing daylight Mazda lamps in suitable deep-bowl steel reflectors to protect the eye is satisfactory. This should be supplemented by a moderate intensity of general illumination for lighting the shelves and cabinets. Where a considerable amount of matching artificial teeth must be carried on, an accurate type of color-identification unit is a necessary element of equipment.

Conclusions as to Lighting of Hospitals and Dental Laboratories.

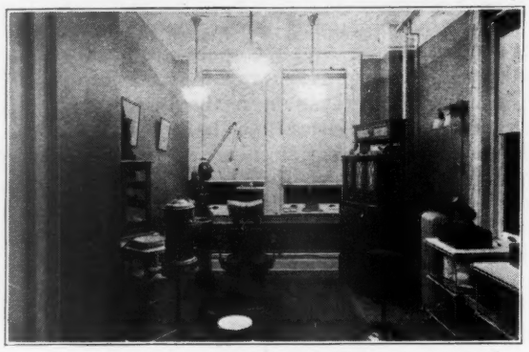
The attempt has been made to point out some of the features which must be observed if satisfactory illumination effects are to be secured. It will be evident that considerable variation as to system and intensity is quite within the range of good practice. The art of lighting is in a state of flux, and developments come to the surface every few days which mark an advance. Those in authority in the hospital should be awake to the



Sketch Showing Arrangement of Glass Disc Over Mouth of Indirect Unit, Permitting Ready Cleaning.

new things in lighting, and endeavor to keep their institution up to the minute and provide for the comfort and convenience of the patients in the most efficient manner.

On the other hand, no matter how carefully the lighting may be designed and installed, if it is to perform its proper functions it must receive attention. Observation indicates that in almost every field of lighting it is common practice to install units and think no more about them until something goes wrong. If instruments and other



Small Dental Office Lighted by Three 200-Watt Daylight Lamps in Semi-Indirect Bowls—Uniformly Distributed High-Intensity Illumination of Suitable Color Is Produced.

apparatus were neglected they would soon become rusty and unsanitary. The lighting system must also receive proper attention as to maintenance. Lamps become blackened if they are used beyond their normal life, and fixtures and reflectors accumulate dust and dirt which cuts down the illumination a remarkable degree.

An accurate record should be kept of all the lighting equipment installed, and lamp renewals should be made in accord with this record. There are undoubtedly a number of types of fixtures throughout the building requiring different sizes of lamps. When one burns out, it should not be replaced by any lamp that happens to be most handy. Care should be taken to replace lamps with the same size and type as were intended for use in the given fixtures. Careful attention to such details as these will keep the system at top-notch efficiency.

APPARATUS FOR TESTING DRY CELLS AND BATTERIES.

The Bureau of Standards, Washington, D. C., has issued technologic paper No. 171, entitled "Automatic Apparatus for Intermittent Testing," which describes equipment devised to meet the needs of the bureau in making tests of dry cells and storage batteries, but is applicable to nearly any form of intermittent testing requiring the closing of electrical circuits at regular time intervals. The particular advantages of this type of apparatus for making these tests are: Elimination of rapidly moving parts, accuracy of the time intervals, and possibility of making a number of different tests simultaneously with the same apparatus.

CHICAGO CONTRACTORS' OUTING.

Many of the members of the Electrical Contractors' Association of Chicago laid aside business cares Sept. 30 for the final outing of the season. Those who cared for golf played a farewell game at the Harlem Golf Club links while others formed a gallery.

Distinctive Features of White Mazda Lamps

Softness of Light Due to Diffusion Results in Illumination Without Glare—Special White Glass Assures Permanence of Coloring, Eveness of Distribution and Low Brightness of Light Source

Within the past few years many illuminating engineers have been turning their attention more and more toward the elimination of the bugbear of many lighting installations—glare. Although much has been done to minimize this evil in industrial installations, until recently little consideration has been accorded it in residential lighting. The newly developed white Mazda lamp, on account of the softness of its light, has proved especially effective in reducing the glare so often found in lighting units in the home.

Diffusion of Light Distinctive Features of White Mazda Lamp.

The outstanding characteristic of this lamp is the diffusion of its light. The bulb is made of a special white glass, designed expressly for the purpose of minimizing glare. The large volume of light which the filament emits is diffused to the point where the bulb itself appears luminous. The brightness of the bulb is about 13 candlepower per square inch over the brightest square inch of area, which is, of course, far below that of the filament of a Mazda lamp.

It has been pointed out by many illuminating engineers that glare (which, however defined, is ultimately light that hurts the eye) is to a considerable extent a matter of brightness contrast. The illustrations of automobile headlights, which are glaring at night, but which are scarcely noticeable during the day, may be recalled. Because of the softness of its light, the white Mazda lamp can be used satisfactorily in locations where other incandescent lamps unless frosted would be objectionably bright. Frosting the bulb has always proved an effective means of reducing the brightness of the incandescent lamp, but the practice has not been widely followed largely because the frosted bulb collects dust and dirt more quickly than a clear bulb and is more difficult to clean. The bulb of the white Mazda lamp is smooth and is as readily cleaned as a clear-glass bulb.

The white Mazda lamp is made in the 50-watt size, and notwithstanding the low brightness of the bulb, has an output of approximately 450 lumens. The efficiency of the lamp is about 9 lumens per watt. Its maximum dimensions are about the same as those of the 40 and 50-watt type B lamps; it is 2.5 ins. in diameter at the largest point, as compared with 2.375 ins. for the 40 and 50-watt type B lamps. The lamp is designed for use on standard lighting circuits between 110 and 125 volts, and, in common with all incandescent lamps, operates most effectively at the voltage specified on the lamp.

An especial feature of the new lamp is its tipless construction. This is produced by an ingenious method of manufacture in which the lamp is exhausted through a tube attached to the stem at the base of the lamp. The absence of the tip results in an appreciable reduction in lamp breakage and presents a smooth surface. The 50-watt white Mazda lamp can be burned in any position.

Comparison of Light Distribution of White Mazda and Mazda B Lamps.

The curves given in Fig. 1 show the distribution of light of the bare white Mazda lamp compared with that of the bare type B lamp. As would be expected, due to the diffusive quality of the bulb of the white lamp, the distribution curve shows a greater candlepower end-on than in the case of the clear type B lamp.

In Table 1 are given the results of tests made

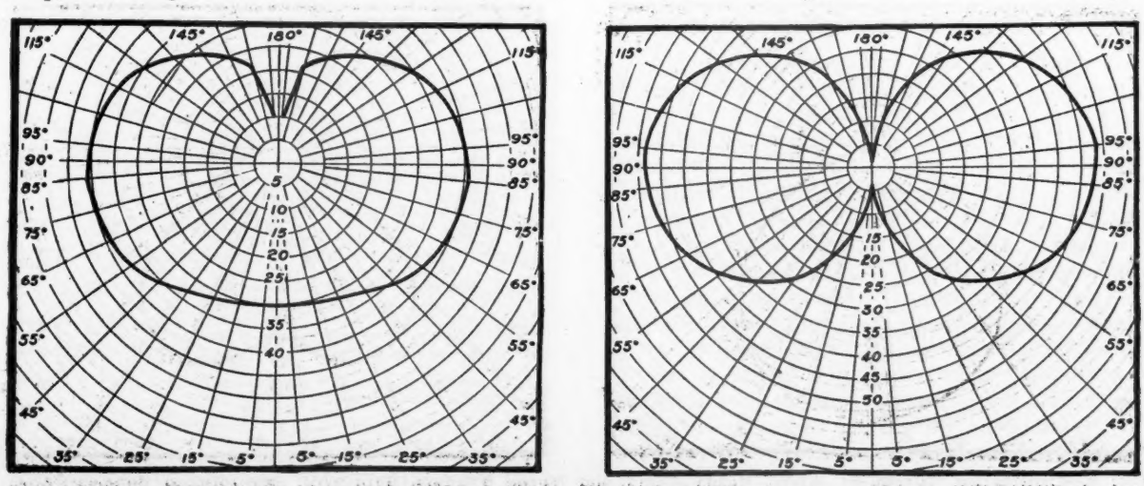


Fig. 1.—Candlepower Distribution Curve of Bare White Mazda Lamp and Bare Mazda B Lamp.

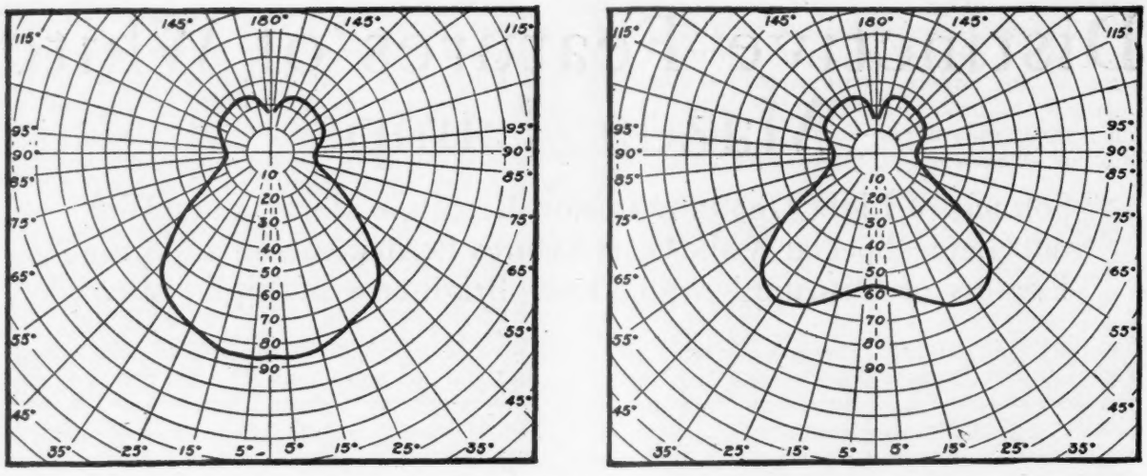


Fig. 2.—Distribution Curves of White Mazda Lamp and Mazda B Lamp, Both With Bowl-Shaped Opal-Glass Reflector.

to determine the effect of the diffusing bulb upon the output of typical lighting units. Figs. 2 and 3 are examples of distribution curves for two common reflectors. It will be noted that there is but little difference in the absorption of any of the units tested, when equipped respectively with type B and with white Mazda lamps. This is due to the fact that the bare white lamp gives a slightly larger percentage of downward light, which compensates for the light lost by cross-reflection between the reflector and the white glass bulb of the lamp, thus making the ultimate results the same.

Broad Field of Application Exists for the White Mazda Lamp.

The white Mazda lamp can be used to advantage in place of the similar sizes of type B lamps in the same reflector equipments. The effect produced by using white lamps in semi-indirect fixtures is particularly pleasing, for distinct shadows of the bowl edge, of the bowl suspension, of the leads, and all striations on the ceiling are eliminated because of the larger area from which the light comes. For the same reason, the white bulbs are also particularly desirable for portable lamps, where their use eliminates the formation of grotesque and annoying shadows upon the walls or upon the pages of a book. For example, fringe shadows, which are often very disagreeable, are eliminated.

With regard to the service which may be expected from white Mazda lamps, it may be said that experience shows a satisfactory degree of ruggedness for the lighting of homes, offices, hotels and public buildings. Increased usage of these lamps is found in the many pleasing effects obtained by their installation at motion-picture-theater and hotel entrances. In many decorative types of fixtures the use of white Mazda lamps has proved effective in enhancing the artistic appearance. The low brightness of these lamps has resulted in their being used in local-lighting units for the inspection of machined interiors and similar places difficult to light with any general lighting system.

TABLE I.—COMPARATIVE DATA ON LIGHT OUTPUT.

Type of Unit Tested.	Output in Per Cent of Bare-Lamp Output. Mazda B.	White Mazda.
Glass bowl, 6-in. dia.	85.4	87.6
Glass bowl, 7-in. dia.	84.8	86.1
Inclosing unit	77.5	76.4
Enameled steel bowl	60.5	61.3

The tendency to use the white Mazda lamp without reflecting equipment because of the softness of its light should be discouraged. For most locations the bulb is still too bright to be

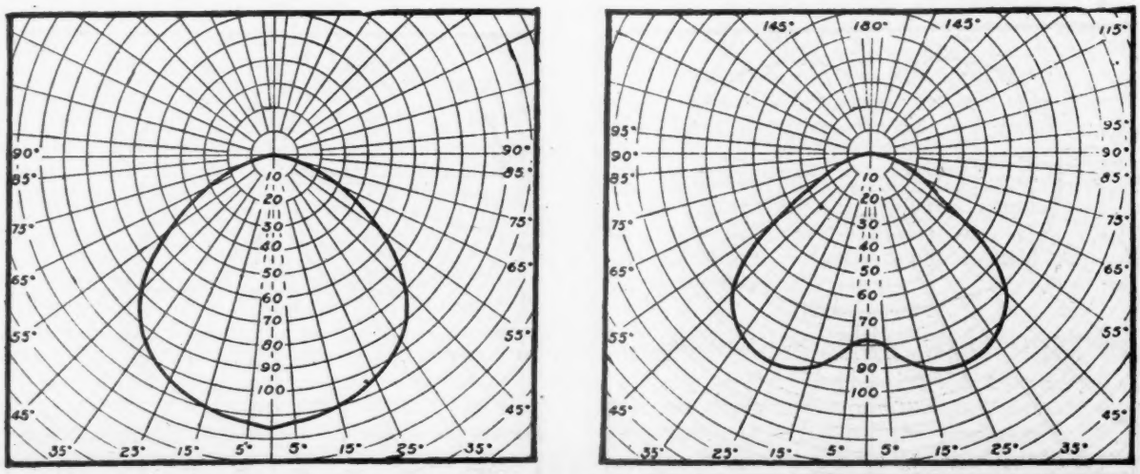


Fig. 3.—Distribution Curves of White Mazda Lamp and Mazda B Lamp, Both With Bowl-Shaped Enameled-Steel Reflector.

used alone, and in addition to reducing glare it is just as important, from the standpoint of effective distribution of the light generated, that a good reflector be used with this as with any other incandescent lamp.

TABLE 2.—FIGURE SHOWING DISTRIBUTION OF LIGHT OUTPUT FROM DIFFERENT LAMPS.

Zone.	Lumens.	Per cent total of clear lamp.
WHITE MAZDA.		
0- 60	108	24
0- 90	234	52
90-180	216	48
0-180	450	100
MAZDA B.		
0- 60	95	20
0- 90	237	50
90-180	235	50
0-180	472	100
WHITE MAZDA.		
0- 60	207	42
0- 90	277	56
90-180	146	30
0-180	423	86
MAZDA B.		
0- 60	197	41
0- 90	264	55
90-180	143	30
0-180	407	85
WHITE MAZDA.		
0- 60	264	54
0- 90	301	61
MAZDA B.		
0- 60	252	52
0- 90	284	59

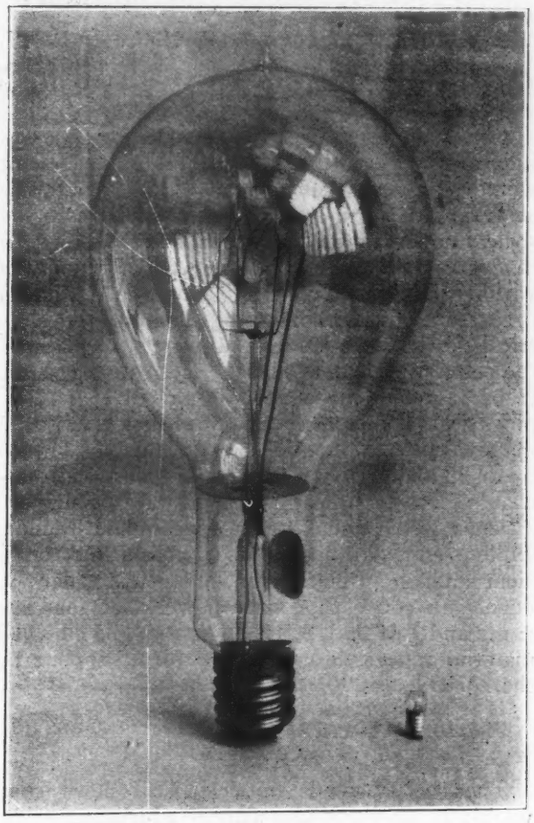
TIME PERIODS IN DEVELOPMENT OF ARTIFICIAL LIGHTING.

Practically All Sources of Present-Day Artificial Illumination Developed Within the Last Century.

Many thousands of years have been required to reach the present state of perfection in artificial illumination. Improvement for long periods were so small as to be hardly worthy of mention, but the developments of recent years have been remarkable indeed. A period of 5000 years was required to progress from the first lamp using animal oils for fuel to the time of the gas light, while within the past hundred years, gas, petroleum and finally electric lighting have been inaugurated and perfected. The accompanying table shows in brief the various stages of growth, and the illustration shows the present extremes in incandescent lamp sizes. The larger lamp is one of 1000-watt capacity and the smaller one consumes only 0.8 watt.

TABLE SHOWING DEVELOPMENT OF LIGHT SOURCES THROUGH TIME.

Period.	Chief Light Source and Developments.
Original	Wood fire.
5,000 B. C.	Torches or lighted splinters placed in holders of stone or clay.
3,000 B. C.	Lamps burning animal or vegetable oils commence to be used.
500 B. C.	These lamps, made of brass or bronze, become highly artistic.
50 B. C.	Romans use rushes soaked in grease—forerunner of the candle.
300 A. D.	Phœnicians introduce candles into Constantinople.
400 to 1700 A. D.	The candle, tallow or wax, competes with lamps and lanterns burning animal or vegetable oils.
1700 A. D.	Oil lamps with wicks being used for lighting large areas.
1780 A. D.	Oil lamps are equipped with round wicks and glass chimneys.
1800 A. D.	Gas lighting perfected, but not generally used for some years.
1850 A. D.	Discovery of petroleum revolutionizes oil-lamp lighting.
1879 A. D.	Thomas A. Edison produces incandescent electric lamp.
1885 A. D.	Auer von Welsbach produces incandescent gas mantle.
1895 A. D.	Incandescent electric lights, made with carbon filament, grow in use.
1907-1913 A. D.	Tungsten and gas-filled lamps developed.
1920 A. D.	Incandescent electric lamp, highly developed, gives brilliant light.



Largest and Smallest Incandescent Lamps Made.

The range of capacity in these two units is indeed great, and represents a selection of lighting intensities available in former years only with equipments of much greater variation in size or convenience.

PUBLICATIONS OF BUREAU OF MINES.

The Department of the Interior, Bureau of Mines, announces the publication of three new technical papers and one new bulletin as follows: Bulletin 182, "Casing Troubles and Fishing Methods in Oil Wells," by Thomas Curtin; Technical Paper 233, "The Properties of Some Stoneware Clays," by H. G. Schurecht; Technical Paper 230, "Deterioration of Molybdenum," by J. P. Bonardi and Edward P. Barrett, and Technical Paper 238, "Indicators for Carbon Dioxide and Oxygen in Air and Flue Gas," by L. H. Milligan, D. O. Crites and W. S. Wilson.

Only a limited supply of these publications is available for free distribution and applicants are asked to co-operate in insuring an equitable distribution by selecting only publications that are of especial interest. Requests for complete lists will not be granted.

Work of the Society for Electrical Development

Valuable Electrical Statistics Compiled to Form Reference Library — Development of Everything Electrical Promoted — Impressions Gained from Visit Paid the New Offices of the Society

To say the least, the nature and scope of activities of the Society for Electrical Development would be a revelation to many. The new office at 522 Fifth avenue, New York City, where the society now maintains its headquarters, is modern in every way and is equipped to carry on the various activities in which it is engaged. A daily-press scrap book, containing clippings of electrical stories printed in newspapers throughout the country is one of the many interesting records to be found in the offices. Many of these clippings feature an entire page of electrical editorial matter supplied by the society and surrounded by display advertising of the local electrical merchants. Pages from newspapers of Washington, Arizona, Ohio and Canada appear side by side, while even a daily paper in Honolulu finds sufficient interest in electricity among its readers to devote an entire page once a week, half advertising and half text, to the industry. The editorial material appears in exactly the form supplied by the society.

News of Electrical Industry Supplied to Many Papers.

The society sends out electrical news copy weekly to over 600 newspapers which appreciate this service and use the material in the above described way, or as "filler-in." Another scrap book displays pages of reading matter, promoting electricity and electrical devices, published in the popular magazines and trade journals and prepared for this purpose by the editorial staff of the society.

The library and statistical department, with lines of filing cases and reference shelves, is another source of interest. Everything is so thoroughly indexed and classified that all of the published press material, technical and editorial and on any particular subject, is grouped under the proper heading and is available in a moment to anyone desiring or having real use for the information.

Files Contain Varied Information on Electrical Subjects.

The electric rates, capacity, etc., of every central station in the United States supplying electric light and power are card-indexed, and the electric codes of 28 states are on file. The enormous value of these files to the industry in research work, and in answering the varied questions propounded by seekers of knowledge scattered broadcast, can be readily realized. In one month questions so widely diverging as special information on electric ranges and other appli-

General Manager J. M. Wakeman of Society for Electrical Development in His New Office.

Office of the Secretary-Treasurer of Society for Electrical Development.

ances, information on thawing pipes by electricity, suggestions for a speech to be made at a woman's club and help in designing a booth at an electrical show, have been correctly answered and satisfactorily supplied. It is rare for the society to be unable to furnish requested information.

An editorial staff is kept constantly occupied preparing news and educational articles for publication in newspapers and periodicals. Booklets containing suggestions for sales campaigns, advertising copy, window displays, etc., are distributed and a "Monthly Sales Service" organ of illustrated newspaper advertisements, suggestions for circular letters, merchandising ideas and news copy is published for the use of members. The society has been in existence for the past eight years, and within the last six years has conducted several great publicity campaigns. It has safeguarded the interests of the great electrical industry from harmful advertising, injurious reports of fire and incorrect accounts of accidents alleged to be caused by electrical mishaps. Valuable assistance is rendered to the central-station man, jobber and contractor-dealer in his merchandising problems, and to the public by collecting and disseminating useful electrical information.

Conferences Co-ordinate Work of Various Departments.

In order to insure close co-operation between the different departments of the society, and to

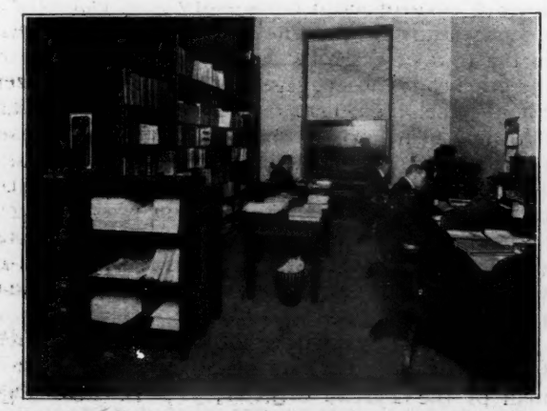
Weekly Meeting of Staff of Society for Electrical Development.

co-ordinate its efforts with a view to securing the maximum results, a weekly staff conference is held. This conference is attended by the various members of the staff who are responsible for the different activities. At this conference the work of the society is planned, with everyone on the staff contributing their expert opinions and suggestions. If the plans are for any extensive campaign activity, they are submitted to the executive committee for approval and, after passing that committee, they are carried out by the staff under the guidance of the general manager, J. M. Wakeman. Mr. Wakeman's previous broad experience fits him peculiarly and particularly for this work.

Field Men Supply the Office Organization With Accurate Information.

Further development and execution of the plans form the topic for the weekly staff conference which, from time to time, receives the personal reports of the field representatives. Thus, the field men are able to keep the staff in close touch with the industry. Not the least important service rendered by the society to the industry has been the originating and popularizing of the slogan "Do It Electrically!" which has become known from the Antipodes to Canada and from European countries to the Orient.

The society, of which W. W. Freeman is president and Charles L. Edgar is chairman of the executive committee, is supported by subscriptions from central stations, manufacturers, jobbers and contractor-dealers.



Statistical Department of Society for Electrical Development.

View in Library of the Society for Electrical Development.

DIRECT AND DIFFUSED LIGHT FROM A FLOOR LAMP.

Results of Tests to Determine Proper Proportions—From Paper Before Illuminating Engineering Society.

By J. R. Cravath.

A room 16 ft. long by 12.5 ft. wide, having a nearly white ceiling, yellow walls, natural oak wood trim and floor, and a brown predominant rug, was used for the purpose of the testing of proper floor-lamp lighting. Direct light from the lamp was limited to a cone of about 38 degrees from the vertical and was approximately constant. The lamp filament was 66.5 ins. above the floor. Indirect light was emitted from the top of the lamp in varying amounts through screens made of tracing paper, the number of thicknesses of which was varied to give 15 approximately equal steps. The general plan therefore was to keep the direct component of light constant and vary the indirect component according to the tastes of the various observers who were tested. The tracing-paper screens were simply laid on top of the shade of the floor lamp and consequently acted both as absorbers and diffusers. With the screens removed the cut-off line of the cone of indirect light was about 28 degrees above the horizontal.

The shade of the lamp used consisted simply of a cylinder of heavy yellow drawing papers which gave a pleasing color effect. A cone of drawing paper was used inside the shade to protect the observers from the white interior. An upright 200-watt lamp was used as a light source. The lamp as arranged gave a direct-light component of about 15 foot-candles. These as actually made involved the judgment, after numerous trials, of 25 different persons, both men and women and of various ages from 16 to 67 years. Trials were made for general effect and for reading, and measurements of illumination were made in various places about the room.

In conclusion Mr. Cravath states regarding the practical design of floor lamps:

(1) A greater percentage of diffuse light would probably add to the comfort of reading. (2) The test room was lighter in general color than the average, so that more diffuse light should be provided. (3) The general illumination around the room called for by the results of these tests, while pleasing in general effect, is rather low for practical utility, for such purposes as occasional reading of a few lines, changing of phonograph records, lighting pictures, etc.

The distribution of light flux which proved to be the most popular show characteristics which, as far as the writer knows, are not possessed by any floor light on the market today. The chief peculiarities of this distribution are the small flux at and near the horizontal, and the large amount of flux below 40 and above 120 degrees.

The total amount of light flux emitted from the unit (362 lumens) is surprisingly low, considering the high degree of local illumination and the satisfactory general illumination of a room of this size. A 75-watt, 865-lumen lamp in a unit of 42% efficiency would give the 362 lumens required.

The majority of floor lamps, if of the umbrella type now in vogue, would give much less indirect component, and the direct component would generally be distributed over a much wider area, frequently at the expense of the eyes of those sitting about the room facing it. At the same time, the intensity of the light near the lamp, for reading and sewing, would be much less.

TEST OF ELECTROPNEUMATIC BRAKE SUCCESSFUL.

Electrically Equipped Brakes on Pennsylvania Train Obviates Objectionable Slack Action Between Cars.

One of the first trains equipped with the three-wire electropneumatic brake and telephone system to be operated over any railroad in the world is now in operation over the Tyrone division of the Pennsylvania railroad, between Tyrone and Williamsport, Pa. The train was first taken over the division early in September, when the experiment with the new system proved to be a success.

The object of the electropneumatic brake is to secure a rapid simultaneous application and a graduated or direct release of the brakes on all cars regardless of the length of the train, thus avoiding the objectionable slack action between cars. A turbogenerator, situated at the top of the smoke box, generates direct current at a pressure of 110 volts for actuating the electric magnets on the universary valve of each. When the engineman switches on the current and applies the air brakes, he is enabled to make a quick, smooth and safe stop, and the objectionable slack action between the cars is avoided. In case trouble should develop in the proper operation of the electric feature, the engineman has but to open the switch on the circuit-breaker and operate the brakes pneumatically.

Two of the coaches, the baggage car and the engine are fitted up with telephone wall sets, those in the coaches and the baggage car being placed on the inside at the front end, and the engineman's set within convenient reach on the inside of the cab. This puts the members of the crew in direct communication with one and another at all times.

The engineman receives his telephone signal from a small electric horn—very similar to the electric automobile horn—placed over his head in the roof of the cab. The telephone signal in the coaches and baggage car is an electric buzzer. Should the engineman desire to communicate with any member of the crew he merely presses the button, takes down the receiver, and speaks. In one of the tests on the trial run the engineman called the conductor when the train was making 60 mi. per hr., with the injector and safety valves working, and above all this din and roar, the conversation was carried on without appreciable trouble.

Those who accompanied the train on the initial trip were: Edward P. Black, traveling engineman of the Tyrone division; J. B. Grosswege, J. W. Henry and D. A. West of the Westinghouse Air Brake Co., Pittsburgh.

EDITORIAL COMMENT

High Cost of Poor Lighting

Much has been said about the cost of electrical construction, cost of maintenance, cost of operation and, in total, about the cost of good lighting. However, fully as much, if not more, can and should be said about the cost of poor lighting. This subject of poor lighting is one that deserves the attention of the entire lighting industry as well as that of all industry. If poor lighting is costly, it is time to abandon it and adopt standards that are better and at the same time cheaper. The cost of poor lighting was treated in a most instructive manner in a paper presented by R. E. Simpson at the recent convention of the Illuminating Engineering Society, and the following quotations were taken from this paper.

"When a factory owner receives a bill from the gas or electric company, he feels that he has at least one definite item on which to base his overhead costs. Moreover, he doubtless notes with satisfaction that there has been little if any increase in the service rates during the last five years and is duly thankful that, in this age of high costs, the prices of the gas and electricity that are necessary in his business have remained somewhere near the pre-war level. A closer analysis of the various factors entering into the overhead cost of production may disclose, however, that owing to circumstances which are entirely within his control, he is not getting an adequate return for the money expended. A manufacturer should not be satisfied with his illumination, nor can he definitely ascertain the correct charge for that illumination, until he has proven conclusively that it is impracticable to increase the productive capacity of his plant, or to decrease the percentage of spoilage, damage to apparatus, intentional lost time, and the accident rate, by varying the intensity levels or making other changes in his lighting system.

"It has been definitely established that, ten years ago, approximately 24% of our industrial accidents were caused by poor lighting. In the intervening decade much progress has been made in the art of illumination and in promoting the safety of workers, with the result that this percentage has been considerably reduced.

"A complete survey of accident reports for the past year, such as was made for the year 1910, has not been made, but a rather limited observation of reports, coupled with personal investigation and study, leads to the conclusion that at the present time approximately 15% of our industrial accidents may be attributed to improper illumination. Even a cursory study of the subject will reveal the fact that of late years only a minor percentage of what we may term lighting accidents are due to insufficient illumination. We find, instead, that accidents that may be charged to faulty illumination are mostly caused by continued eye strain with its general detrimental effect on our physical well-being, by sporadic but more acute eye strain, and by glare—all brought about by improper use of light sources."

Estimates made of the costs of industrial accidents designate a total annual sum of $300,000,000 as being chargeable to poor lighting. This amount is so large as to be almost unbelievable, representing a cost in excess of the entire annual bill for industrial lighting. With such a sum to work from, and check the costs of improved conditions against, surely there is ample room to carry out many improvements. The saving of even one-third of this total would be an economic gain of no small value to the country. However, other factors fully as important and vital as the actual monetary loss due to accidents must be considered. Accidents, accompanied by their resultant absence from duty, impose a vastly heavier burden on industry than the wages lost by injured employes.

Other figures, representing a typical case, show an industrial plant as paying a monthly lighting bill of $375 and, at the same time, paying in the insurance premium a sum of $866 to cover the liability for accidents due to poor lighting. With such conditions prevailing, it seems evident that the various interests of the lighting industry would do well to get together and solve the lighting problems of industry. There is room for profit to all branches of the industry in such a program. And, at the same time, there can be no hardship worked on anyone by the reduction of accident-insurance costs. The insurance company does not profit by the collection of premiums that are paid out for injury, the plant owner surely would rather pay lighting bills than insurance premiums, and employes prefer to work at full pay to being disabled at half-pay, or at any price. The problem is ready for solution, the cause is worthy, the profits to be made are substantial, and it is up to the industry to take advantage of the opportunity.

THE WEEK'S NEWS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

JOINT MEETING OF N. A. E. I. AND ELECTRICAL CONFERENCE.

The Electrical Conference and the National Association of Electrical Inspectors will hold a joint meeting of the Middle Department at 316 Walnut street, Philadelphia, Oct. 12. The proceedings will be opened at 10:00 a. m. by the Hon. J. Hampton Moore, mayor of Philadelphia. A. R. Small, of the Underwriters' Laboratories, will speak on approved devices and the work of the laboratories in general, and Dana Pierce, vice-president of the Underwriters' Laboratories, will talk on some laboratory and inspection problems. "Safety to Life" will be the subject of an address by Dr. M. G. Lloyd, Bureau of Standards. W. J. Canada, engineer of the National Electric Light Association, will thoroughly explain Rule 15A. The meeting will also be advised of the changes in the National Electrical Code, and will be told and shown how the neutral ground can be installed with much less cost than formerly, as well as other important features. On Tuesday evening there will be a banquet at the Hotel Adelphia.

CONTRACTOR-DEALERS IN ANNUAL CONVENTION AT BALTIMORE.

Reports of Committees at Early Executive Sessions Show Much Excellent Work Accomplished for Association During the Past Year.

The twelfth annual convention of the National Association of Electrical Contractors and Dealers, in session at Baltimore Oct. 4-9, was the most beneficial and instructive meeting thus far recorded in the history of the association. It was crowded with business details from the fall of the gavel on the opening of the first session of the executive committee until the adjournment of the last session.

Among the reports made at the first session of the executive committee was that of the committee on cost data, of which Kenneth A. McIntyre was chairman. This committee has been absorbed in an effort to procure time studies of electrical construction work on which to found basic cost data. While some progress was reported in the work of interesting members in the proposed plans, it was conceded that the time is not yet ripe for such time studies because of unsettled conditions involving labor costs and prices of materials.

The report of the code committee, submitted by Chairman A. Penn Denton, with a supplemental report by W. Creighton Peet, chairman of the association, indicated excellent work in adjusting complaints and furthering the interests of the members. Progress was reported by Chairman George M. Chapman, of the standardization committee, in the campaign for standardization of plugs and receptacles.

Joseph A. Fowler, chairman of the committee on universal data and sales book, reported the issue since Jan. 1, of 287 new and revised data sheets which were distributed to 2160 sales books, involving the handling of more than 600,000 sheets. The addition of the condensed material and appliance section to the data, supplied members since the first of the year, was also reported.

Other reports were received from Robley S. Stearnes, chairman of the United States Chamber of Commerce committee; J. E. Sweeney, chairman of the credit and accounting committee, and from J. A. Fowler, chairman of the liability insurance committee. More complete details of the convention will be reported in the next issue of ELECTRICAL REVIEW.

MANY TOPICS DISCUSSED BY ILLUMINATING ENGINEERING SOCIETY.

Well-Arranged Program Proves Interesting and Beneficial to Delegates at Fourteenth Annual Meeting of Society.

Evidence of widespread interest in illumination and of the important part illumination plays in human endeavor and life was manifested in high degree at the fourteenth annual convention of the Illuminating Engineering Society, held this week at the Hotel Statler, Cleveland. Nearly 300 members were registered at the convention, who, with their guests and representatives from practically all other branches of the electrical industry, made a gathering that testified to the importance of electric lighting. The program included over 20 papers, dealing with a variety of subjects from the highly theoretical to the purely practical aspects of the art. The list of subjects was so well balanced and they were so well treated and discussed that it would be difficult to point to any one as featuring the convention.

Intermingled with the eight technical sessions, held on the four days of the convention, was an entertainment program that rivalled in excellence any that has ever been enjoyed by the organization. The Electrical League of Cleveland, aided in great measure by the National Lamp Works of General Electric Co., and other Cleveland electrical concerns, provided facilities and entertainment for the delegates that added much to the success of the meeting.

President S. E. Doane, in his opening address, stated that the past year has been marked with a growing knowledge on the part of the public to the need of better illumination. One of the paramount aims of the Illuminating Engineering Society is to increase that knowledge. The society has two functions: (1) to serve those

needing assistance in lighting problems, and (2) to serve as a medium for those who wish to help mankind by improvements in lighting. Mr. Doane spoke of plans to improve the *Transactions* of the society in order to disseminate information more rapidly. It is proposed to issue bulletins, including symposiums, compilations, etc., for the benefit of members, and also to furnish to educational institutions and to industrial organizations records and information on subjects within the scope of the society.

Mr. Doane also pointed out that the need of better illumination was being successfully demonstrated, but that there should be augmented efforts along this line. The importance of the illuminating engineer is becoming generally realized, but there is necessity for his financial recognition.

Reports of Officers and Committees Show Much Progress During the Year.

The report of General Secretary Clarence L. Law was read by Assistant Secretary Sherwood, and referred, in the main, to the progress made in membership. There has been a substantial gain during the year, bringing the total to a point greatly in excess of pre-war figures. The potential field for members is enormous, and plans for a membership campaign were outlined. An amendment was proposed providing for student members.

The report of the committee on progress, presented by F. E. Cady, chairman, was a classic in its content and completeness as to the most important developments in the illuminating field during the year. Among the advances mentioned were the improvements made in the mechanical perfection of incandescent lamps. Increase in the use of electricity for illumination was shown by data from central stations giving a growth of residential customers in the United States from 3,434,900 in 1915 to 6,517,600 in 1920, and of commercial lighting customers from 1,085,900 in 1915 to 1,675,900 in 1920. Magnitude arc lamps have been improved by use of a flattened electrode. The Moore tube gaseous-conductor lamp has been developed for 220-volt circuits, without the use of any auxiliary starting device. Special attention has been given to improvements in uniformity of dimensions of automobile lamps, and also to incandescent lamp equipment for motion-picture projection.

Highway lighting has received a decided impetus through the interest of the Good Roads Association, and there has been a general tendency to again take up in various municipalities the installation of street-lighting equipment. The tendency, except in units mounted 25 to 30 ft. above the street, is towards the use of standards surmounted with single globes. Interior lighting received added consideration, the need for maintenance being emphasized. The candelabra fixture has been the dominating idea of the year in the development of residential lighting units.

Very little has been reported on the subject of photometry during the year, what has appeared being in the nature of apparatus and methods for special purpose instead of the ordinary measurement of luminous sources.

In connection with lighting legislation, the Ohio industrial code was adopted and the Wisconsin code was put into effect for existing as well as new installations.

The report of the committee on education, Prof. F. C. Caldwell, chairman, gave an outline of progress in the movement to educate the public in lighting. The field was classified as (1) the college student group; (2) those whose present occupation places them in need of information about illumination; (3) school children, and (4) the light-using public. Plans for reaching these fields were given in the report.

C. H. Sharp presented the report of the committee on automobile headlighting specifications, stating that numerous states had adopted the I. E. S. system. Conclusion was made to the effect that education of the public was necessary to enforce the regulations. The report was discussed by Messrs. Engle, Hoeveler and Cravath, the former speaking of the effect of glare and kinds of lenses. Mr. Hoeveler spoke of the procedure in Wisconsin in enforcing laws pertaining to headlights, while Mr. Cravath said it was necessary to perfect devices permitting adjustment of the beam of light. W. F. Little showed by means of slides the effects of different kinds of headlights at specification points on a road. George H. Pinckney said glare could never be entirely eliminated. In closing the discussion Dr. Sharp said the construction of headlights is somewhat faulty and that the committee's endeavor is to advocate the best use of light, eliminating all objectionable features possible.

Following the discussion, H. H. Magdick and Howard Karg presented a survey of voltage conditions in automobile lighting. Measurements were made of the voltage at each of the lamp positions of 55 automobiles representative of different makes of lighting systems. The conclusions reached were that there is need for greater standardization and better selection of generator and battery capacities, further standardization of generator characteristics, improved switches and sockets, more rigid standards as to material and assembly of parts, and the development of a regulator to reduce voltage variation.

Discussion of the Various Theories of Light and Its Transmission.

In a paper on "Modified Views on the Theory of Light," presented by Dr. E. F. Nichols at the Tuesday morning session, he discussed the corpuscular or projectile theory and the wave theory, together with effect on them of theories advanced during the past 25 years in correlated fields. He concluded with the statement that more is known about light than ever before, but that the theoretical physicist has yet a very hard task and an even greater opportunity to connect up the new knowledge with the old, and harmonize both into a comprehensive and authoritative theory of light.

In the discussion, Dr. Louis Bell said it was a struggle with minute mechanisms, the fundamentals of which are not known and which would probably reveal a fineness of structure far beyond the atomic and electron theories.

"Some Applications of the Photoelectric Cell to Practical Photometry" was the title of a paper by W. E. Story. The method described offers the advantage of freedom from personal judg-

ment of the operator; flexibility of sensitivity over a considerable range; possibility of controlling large quantities of energy through operation of relays by the amplified cell current, and automatic registering of changes of illumination with change of distance, area, shape, etc. The limitations of the cell are (1) a gradual change of sensitivity with time; (2) a color sensitivity differing from that of the eye, and (3) difficulties of insulation usually met with small electrical currents. The discussion, participated in by Messrs. Sharp, Gage and Cady, was concerned chiefly with the manner of handling the cell and the fact that measurements were not made in absolute terms. Mr. Story answered that the photoelectric cell method is designed for the purpose of determining relative quantities of light.

A paper on "The Optical Principles of Illuminating Engineering," by P. G. Nutting, was read by title. The paper dealt with the interrelation between optical and illumination principles, which were summarized as follows: (1) The number, character and intensities of light sources determine, by well-known optical principles, the illumination; (2) the nature and intensity of the illumination, together with the reflecting and transmitting power of the objects illuminated, determine the brightness and contrast in the objects viewed; (3) brightness and contrast in the field of view determine luminous flux density at the retina, and (4) the character, intensity and distribution of luminous flux density at the retina, with the receptive processes of the retina, determine the nature of the sensation produced.

A procedure whereby the reflection factor of any surface, whether matte or glossy, may be measured by an absolute method was described by C. H. Sharp and W. F. Little in a paper on "Measurement of Reflection Factors." The test results confirm the validity of the method, but further theoretical and experimental work is necessary to determine the best conditions as to size of sphere, lighting, photometric arrangements, etc., for obtaining the highest precision. For ordinary industrial purposes the results are satisfactory. The fact that measurements can be made on very small samples is an advantage of considerable importance.

Measurement of Diffuse Reflection Factors.

The measurement of reflection factors of surfaces such as walls and ceilings is of value in planning lighting installations, and previous to this time there has been no accurate and convenient instrument for this purpose. Several methods have been used, but most of them have been incorrect on account of an erroneous value assigned to the standard surface. In a paper on "A Simple Portable Reflectometer of the Absolute Type," by A. H. Taylor, was described an instrument which does not require a reproducible standard surface. It consists of a hollow sphere with a segment of the surface cut off. It is painted white inside, and light is projected through a small hole in the wall onto the sphere wall or onto the test surface over the opening. It can be adapted to use with any portable photometer and gives absolute reflection factors.

G. M. J. Mackay presented a paper on "Knowns and Unknowns of Light Production," a theoretical discussion of methods of light production and efficiency of illuminants.

At the Tuesday afternoon session the committee on papers presented a preliminary draft of a paper on "Knowns and Unknowns of Illuminating Principles," which gave established, indicated and undetermined definitions of such terms as intensity of illumination, direction of light, shadows, brightness, color, glare, etc. The paper is subject to criticism by the members of the society and will be published later in revised form.

This paper was followed by one on "The Effect of Variations in Intensity of Illuminations on Functions of Importance to the Working Eye," by C. E. Ferree and Gertrude Rand. Intensity is only one of the lighting factors which influence the functional powers of the eye. One effect of increase of intensity may be obtained for a good installation, while a quite different effect may be obtained for another installation where the increase of intensity is accompanied by an increase in the number or the brilliancy of the bright surfaces in the field of view. The paper dealt with conditions in which the increase in intensity did not result in the introduction of harmful glare. Wide ranges of intensity were employed and the effect on other functions of importance to the working eye were investigated, such as acuity, power to sustain acuity, speed of discrimination, and speed of adjusting the eye for clear seeing at different distances. The effect of increase of intensity was measured on normal eyes and on eyes with small errors in refraction of a type and amount of frequent occurrence.

Bassett Jones caused considerable comment with his paper on "Brightness," in which he questioned the validity of present methods for measuring and determining units used in illuminating engineering. Is brightness a function of luminous objects or is it a function of the observer's visual experience of such objects? His conclusions were that the objective brightness of lumious objects should be treated independent of the sensibility of an observer's eye, and that a direct relation between the brightness of a source and the brightness of the illuminated object should be provided. The chief discussion of the paper consisted of a written communication by Dr. A. S. McAllister.

High Lighting Standards Discussed and Demonstrated.

A session was held Tuesday evening at Nela Research Laboratory, at which was presented a paper on "Central-Station Methods for Securing High Lighting Standards in Stores and Homes," by O. R. Hogue, J. J. Kirk and E. D. Tillson, Commonwealth Edison Co., Chicago. Results of the residential lighting survey made last year in Chicago were fully outlined, and then methods of improving existing installations and fixtures were demonstrated by actual fixtures and by lantern slides.

A demonstration of lighting effects in the home and the effect of color of light in industry and art was given, together with the demonstration of industrial lighting. Motion pictures on various

lighting subjects were shown, the evening's program concluding with an inspection of the automatic bulb-blowing machines at the Pitney Glass Division of the National Lamp Works.

The results of preference tests, made by 25 observers, as to the most pleasing proportions of direct and diffused light from a floor lamp under certain specified conditions in a given living room were stated in a paper on "Pleasing Proportions of Direct and Diffused Light from a Floor Lamp," by J. R. Cravath. Direct light under the lamp was constant and the diffuse light varied. Curves and tables showed the range of illumination and brightness offered, the proportions preferred and the distribution of the light flux about the lamp with the most popular proportions.

S. G. Hibben gave some very practical suggestions in his paper on "Some Out-of-the-Ordinary Applications of Industrial Lighting," showing methods of mounting reflectors and lamps in places not readily accessible, of allowing for clearances of cranes in steel mills, special fixtures for lighting acid plants and powder mills, and other examples of departures from the usual practice in installing lighting equipment. In discussing the paper, Bassett Jones spoke of the disadvantages of too much window space in factories and its effect on the artificial lighting. J. R. Cravath said factory owners should whiten the interior walls of building to get rid of contrasts in lighting. J. Daniels pointed out the necessity of familiarity with Code regulations in making factory installations. Others who discussed the paper were Otis L. Johnson, Davis Tuck and H. B. Anderson.

Improved methods of illuminating motion-picture theaters were given by L. A. Jones in a paper on that subject. Recommendations as well as layouts for a typical theater were included. Dr. Gage brought up the question of whether or not it is desirable to provide a slight degree of illumination for the audience, and F. E. Cady spoke of the distraction caused by musicians' and exit lamps.

The society's work among other organizations was summarized in the report of the committee on reciprocal relations, presented by Ward Harrison, chairman. This committee was created during the year and has already done much valuable work, to the benefit of other industries as well as the lighting industry. George H. Stickney said there remained a great deal for the committee to do, that its field of endeavor was unlimited. He urged co-operation with the lighting fixture manufacturers to get an interchange of views on common subjects. There is much that the sections of the society can do in their individual localities. Others who commented on the work were A. D. Curtis and J. D. Israel.

Economic Losses Resulting From Poor Illumination.

The influence that color will play in the art of illumination was clearly shown in a paper on "Recent Applications of Color in Lighting," by A. D. Curtis and J. L. Stair. Use of color in theaters and show windows was described, as well as fixtures. Discussing the paper, S. G. Hibben spoke of progress made in this direction in Europe. J. R. Cravath called attention to the practical points in connection with color lighting, stating it was necessary to change colors frequently or localize the color. Norman Macbeth also commented on the paper.

Statistics on the economic loss caused by poor lighting in this country were given in R. E. Simpson's paper on "The High Cost of Poor Lighting." He stated there is a loss of $300,000,000 annually, due to accidents resulting from poor lighting. He made a number of recommendations for alleviating conditions.

An illuminometer which will measure candlepower, millilamberts and foot-candles to a reasonable degree of accuracy, which is readily portable, and which can be obtained for a nominal price was described by Davis Tuck in a paper on "A New Form of Portable Light Meter." A feature of the instrument is its compact construction, it being 12 ins. long with a maximum diameter of 2.125 ins.; its weight is 1.5 lbs. The principle involved is that of the inverse-square law. Ward Harrison and George H. Stickney commented on the degree of accuracy obtained with the instrument, its usefulness and handiness, and also on the fact that it gives definite values. Prof. F. C. Caldwell and J. A. Hoeveler spoke of the use that could be made of the instrument in connection with enforcing lighting codes. Dr. Louis Bell predicted that the perfection of the instrument would prove a decided step ahead for the lighting industry.

Trip to Nela Park Made for Demonstration of Factory Lighting.

J. B. Wilson told of the methods employed by his company in obtaining industrial lighting business in Massillon, O., in a paper on "Central-Station Experience in the Improvement of Factory Lighting." A delegation of general managers and superintendents was taken to witness the demonstration at Nela Park, the result of which was a very decided tendency toward bettering the equipment of factories in that city. The paper was discussed by Messrs. Merrill, Fitzpatrick and Caldwell.

Thursday morning's session was held in the rooms of the Cleveland Electrical League. The first paper was on "Department Store Illumination," by J. Daniels, Edison Electric Illuminating Co. of Boston, who gave the results obtained in a survey of Boston, New York, Philadelphia and Newark stores. It was found that intensities ranged from 1 to 6 foot-candles, and that, as a general rule, most of the stores were greatly under-lighted. The result of the survey has been that most of the Boston establishments have had their lighting improved, with consequent added load for the central-station company. D. McF. Moore, in discussing the paper, said central-station companies should furnish foot-candles instead of watts, and arrangements should be made to furnish light and maintenance at a definite figure. Dr. Louis said the paper indicated the beginning of a big drive by central-station companies for better lighting. He pointed out the advantage of the foot-candle-meter in making class surveys. Norman Macbeth cited some difficulties in making a similar survey.

Methods of improving existing fixtures and securing new business were given in an illus-

trated paper by O. R. Hogue, J. J. Kirk and E. D. Tillson, Commonwealth Edison Co., Chicago. The standardization of fixtures for use in the ordinary small store has proved an important factor in the development of this business. Samples of these fixtures were on exhibition. In the discussion, A. L. Powell said the paper illustrated very well the purpose of the lighting sales bureau of the National Electric Light Association, and expressed the hope that those interested would come to a better realization of the advantages to be gained in standardizing fixtures for small stores. Others who participated in the discussion were Messrs. Kelly and Caldwell.

A. L. Powell and J. H. Kurlander presented a comprehensive paper on the lighting of shoe factories, pointing out the difficulties encountered and their solution by means of correct arrangement and selection of modern light sources. Numerous slides were shown to illustrate installations and a layout for a typical factory was presented. The discussion, participated in by Messrs. Holden, Israel, Caldwell and Kelly, concluded the program of papers.

President Doane introduced Gen. George H. Harries, president-elect of the society, whose term of office began Oct. 1 but who did not assume his duties at that time owing to the postponement of the convention. General Harries spoke of the progress made by the society and called for a concerted effort to further the work during the coming year.

J. D. Israel, chairman of the committee on the president's address, called particular attention to the suggestion for an educational campaign among private concerns and individuals as to the advantages to be gained by better lighting, and H. F. Wallace submitted the report of the resolutions committee, which gave expression of the appreciation of the society to the various committees, concerns and individuals contributing to the success of the convention.

The entertainment provided for the delegates was of particularly noteworthy character. Starting with President Doane's reception Monday evening there was interesting diversion provided for every moment outside the convention hall. A dinner and dance at Nela Park Tuesday evening was followed by the annual banquet Wednesday evening. On the latter evening a novel feature was the exhibition of lighting units typical of the Greek, Roman, Renaissance, Colonial and other periods. Following the close of the convention, General Harries addressed a joint meeting of the Cleveland Electrical League, the Cleveland Engineering Society and the Illuminating Engineering Society, telling some of his experiences in Europe following the signing of the armistice.

FIXTURES COMMITTEE MEETS WITH I. E. S. COMMITTEE.

At the recent convention of the Illuminating Engineering Society in Cleveland, Oct. 4-6, the National Council of Fixture Manufacturers was represented by a committee composed of Fred R. Farmer, Charles H. Hofrichter and W. R. McCoy. This committee met with M. Luckiesh, A. L. Powell and S. G. Hibben of the Illuminating Engineering Society to discuss the various problems involved in fixture design and its relation to illumination. No definite action was taken, but points of difference between the engineers and manufacturers were taken up and a decided inclination to co-operate was evidenced. The manufacturers were anxious to learn what could be done to improve their product. The engineers were shown that the fixture manufacturers did not always make the glassware for their product. As an aid to design, the engineers volunteered to arrange a demonstration of the proper methods of fixture trimming. Arrangements were made for the Illuminating Engineering Society to have an exhibit at the Buffalo exposition of the fixture manufacturers. Another meeting of the joint committee will be held Nov. 11, in New York City.

CANADIAN MARCONI AND GENERAL ELECTRIC INTERESTS MERGE.

Following upon the merging in the United States of the American Marconi Co. and the radio interests of the General Electric Co. under the name of the Radio Corporation of America, announcement is made of a similar merger effected between the Marconi Wireless Telegraph Co. of Canada, Ltd., and the Canadian General Electric Co., a separate company from the American General Electric Co. The capital of the consolidated company will be increased for the purpose of acquiring valuable patents controlled by the Canadian General Electric Co. and for additional working capital.

The officers and directors of the newly merged company are: President, Frederic Nicholls; vice-presidents, William Marconi, A. E. Diment and Robert Bickerdike; managing director, A. H. Morse; Sir William MacKenzie, Godfrey C. Isaacs, G. M. Bosworth and C. G. Greenshields.

FALL MEETINGS OF ELECTRICAL SUPPLY MANUFACTURERS.

The Associated Manufacturers of Electrical Supplies announces that the regular fall meetings of the various sections will be held in the association rooms in New York City during the week of Oct. 18, the specific dates and hours to be announced later. The following section chairmen have been elected:

Air circuit breakers, G. A. Burnham, of the Condit Electric Manufacturing Co., Boston; attachment plugs, A. H. Fleet, of the Cutler-Hammer Manufacturing Co., Milwaukee; armored conductor and metallic flexible conduit, G. F. Holly, of the Youngstown Steel & Tube Co., Youngstown, O.; carbon, J. F. Kerlin, of the Corliss Carbon Co., Bradford, Pa.; electrical porcelain, J. E. Way, of the R. Thomas & Sons Co., New York City; fan motors, Clinton Spark, of the Sprague Electric Works, New York City; fuses, C. A. Bates, of the Bryant Electric Co., Bridgeport, Conn.; heating appliances, F. D. Goode, of the Cutler-Hammer Manufacturing Co., Milwaukee; industrial lighting fixtures, W. D. Steele, of the Benjamin Electric Manufacturing Co., Chicago; knife switches, J. H. Trumbull, of the Trumbull Electric Manufacturing Co., Plainville, Conn.; lamp receptacles and sockets, H. R. Sargent, of the General Electric Co., Schenectady, N. Y.; line material, Louis

McCarthy, of the Macallen Co., Boston; metal molding, C. E. Corrigan, of the National Metal Molding Co., Pittsburgh; molded and formed insulation, Joseph Rockhill, of the General Insulate Co., Brooklyn, N. Y.; non-metallic conduit, Russel Dart, of the Alphaduct Co., Jersey City, N. J.; outlet boxes, G. H. Sicard, of the Pratt-Chuck Co., Frankfort, N. Y.; panelboards and switchboards, C. E. Wilson, of the Sprague Electric Works, New York City; signaling apparatus, T. W. Hess, of the Holtzer-Cabot Electric Co., Boston; snap switches, S. P. Williams, of the Hart & Hegeman Manufacturing Co., Hartford, Conn.; wire and cable, LeRoy Clark, of the Safety Insulated Wire & Cable Co., New York City; rigid conduit, C. E. Corrigan, of the National Metal Molding Co., Pittsburgh.

FUEL ECONOMY DISCUSSED BEFORE CHEMICAL EXPOSITION.

A paper on "Burning Coal at 100% B.t.u. Efficiency," by W. O. Rankin, Quigley Furnace Specialties Co., was one of the features of the Sixth Exposition of Chemical Industries held Sept. 20-25 in the Grand Central Palace, New York City. Other papers of interest to the central-station or industrial-plant manager were as follows: "Saving Fuel by Controlling Chimney Losses," by F. E. Uehling, Uehling Instrument Co.; "Fluid Heat Transmission," by Alexander B. McKechnie, Parks-Cramer Co.; "Producer Gas and the Modern Mechanical Producer," by W. B. Chapman, Chapman Engineering Co.; "Refractory Cement: Life Insurance for a Furnace," by F. W. Reisman, Quigley Furnace Specialties Co.; "Preventing Conduction and Radiation Heat Waste," by S. L. Barnes, Armstrong Cork Co.; "Increasing Conduction and Reducing Fuel Consumption," by W. R. Van Nortwick, The Roto Co.; and "The Reason for Fuel Saving in the Dressler Kiln," by Conrad Dressler, American Dressler Tunnel Kilns, Inc.

N. E. L. A. RECOMMENDS RULES FOR ALL STATE COMMISSIONS.

At a recent meeting in Chicago the Inductive Interference Committee of the Technical Section of the National Electric Light Association recommended that the California rules pertaining to inductive interference, or similar rules wherever possible, be adopted as a basis by the North Dakota Utilities Commission and the commissions of other states.

The Safety Committee, which was in session at the same time, recommended that state utility commissions adopt and put into practice the National Safety Code, 1920 edition, in place of individual state codes. It was pointed out by the committee that state commissions, by using the National Safety Code, could protect themselves and local companies by the customary saving clauses. It was further urged that the general adoption of the code would put the rules into actual practice so that results of their operation could be noted and used as a basis for any desirable changes next year.

Following these recommendations the railroad commissioners of North Dakota have not only adopted the California inductive interference rules but have adopted that portion of the National Safety Code which pertains to overhead line construction.

PACIFIC GAS & ELECTRIC CO. TO INSTALL NEW EQUIPMENT.

The Pacific Gas & Electric Co., San Francisco, has let the contracts for two 40,000-hp., single-runner, vertical-shaft turbines and all generating equipment for Fall River station No. 1 of the company's Pit river development in the Shasta district of California. Allis-Chalmers, Milwaukee, will furnish all the generating equipment and the Westinghouse Electric & Manufacturing Co. will supply the seven transformers.

The new units will operate under a 425-ft. head. The generating equipment includes two 35,000-kv-a. hydroelectric generators for 90% lagging power-factor, 3-phase, 60 cycles, 11,000 volts, 367 r.p.m., with direct-connected exciters and a 225-kw. motor-generator set. The seven transformers will be single-phase, 16,667-kv-a., oil-insulated, water-cooled, outdoor type wound for 127,000 volts high-tension and star-connected for 220,000 volts.

THE UTILITIES COMMISSION LAW STRONGLY SUSTAINED.

The Western Society of Engineers has recently completed a survey of public-utility regulation by state commission, and its conclusions strongly sustain the wisdom of the present law as of great benefit to the public and investors in the securities of public utility concerns. The report in part states: "Any attempt to impair the usefulness of the commission, to abridge its powers, and especially to go back to the old era of political control of utilities in vogue prior to the time when commission regulation became the law, would be a distinct step backward—a grave menace to the industries of the state and to its people."

OFFICERS OF SAN FRANCISCO SECTION, A. I. E. E.

The San Francisco Section of the American Institute of Electrical Engineers has elected the following officers for the year 1920-21: J. P. Jollyman, Pacific Gas & Electric Co., chairman; W. B. L'Hommedieu, Westinghouse Electric & Manufacturing Co., vice-chairman; J. J. Reed, Pacific Telephone & Telegraph Co., chairman of the membership committee; W. B. L'Hommedieu, chairman of the papers committee; Allen G. Jones, General Electric Co., San Francisco, Cal., secretary.

ACTIVITIES OF ELECTRICAL SUPPLIES ASSOCIATION.

A meeting of the Heating Appliance Section of the Associated Manufacturers of Electrical Supplies was held Oct. 7, at which many matters of importance were considered. The regular fall meetings of the sections will be held during the week commencing Oct. 18 in the association rooms, 30 East 42d street, New York City. The Electrical Porcelain Section held its first meeting

since the summer on Sept. 22. J. E. Way, R. Thomas & Sons Co., was again re-elected chairman of the section, with F. L. Bishop, Hartford Faience Co., secretary, and Herbert Sinclair, Star Porcelain Co., treasurer. The board of governors held a meeting Sept. 24 and transacted a large volume of business. The board is now planning an additional line of activities for the sections and several new sections are contemplated.

SUPERPOWER SYSTEM SUBJECT OF N. Y. E. S. LECTURE.

"The Superpower System" was the subject of a lecture by William S. Murray, chairman of the Federal Superpower Survey, at a meeting, Oct. 7, of the New York Electrical Society. The subject was advanced as a logical answer to the immediate future power requirements of the country. It was pointed out that the present form of power generation is so inadequate, as well as uncorrelated, to meet the imminent railway and industrial expansion, that progress in these departments of national life is unquestionably being impeded. The superpower system of the government was offered as the logical and effective remedy of the present situation.

COAL HOARDING CHARGED IN INDICTMENT AGAINST UTILITY.

The Brooklyn Edison Co. Is Accused of Hoarding 50,000 Tons of Coal and Having Contracts for an Additional 50,000 Tons.

Indictments voted on Oct. 4 charge the Brooklyn Edison Co. with hoarding coal and of violating the Lever act. The charges, it appears, are the result of the effort on the part of the company to secure the coal required to carry on its winter's business. It was said that the price paid for some of the coal purchased was higher than it might have been secured for.

In a statement by Mathew S. Sloan, president of the Brooklyn Edison Co., he said:

"Our company learns for the first time that it is a crime under the Lever act for a public-utility company to have on hand enough coal to take care of its needs. We have no excuses to make and are proud of our ability to obtain enough coal to take care of our daily requirements and to build up an adequate reserve to assure the people of Brooklyn of a constant and uninterrupted supply of electricity."

The statement says that no coal had been received from the Adelphia Coal Co. except under a charter dated in 1914, and at a price below the market price for coal of a similar grade at the time.

"Payments by the Edison Company to the Adelphia company, mentioned in the indictment, were for coal delivered and for no other purpose.

"Our company has bought coal at competitive market prices, and we have not paid higher prices for coal than we were forced to pay because of market conditions."

Mr. Sloan asserts that an investigation convinces him that Walter F. Wells, vice-president and general manager, is blameless.

Mr. Wells says he welcomes the opportunity to "demonstrate the propriety" of his official acts.

"I know nothing about the transaction with respect to which I am accused, except that in my service as vice-president of the company I know that coal was purchased from the Adelphia company, and that the prices were less than similar coal cost us from other sources."

BANKERS HEAR REPORT ON PUBLIC UTILITY SECURITIES.

Chairman of Public Service Securities Committee of N. E. L. A. Presents Pertinent Facts on Utility Conditions at Bankers' Convention.

"Much has occurred during the period of reconstruction following the armistice and notably in the last year tending towards the fixing of the status of public utility securities among the premier investments of the country," declared O. B. Willcox, chairman of the Committee on Public Service Securities of the National Electric Light Association, in his report to the Investment Bankers Association of America in convention at Boston, Oct. 5. "The operation of public regulation, the high costs of labor and materials, and of money, the shortage of labor, the congestion in transportation, and the great industrial activity of the country, while leading to embarrassments and difficulties, on the other hand have all helped to the better understanding of the status of utilities in modern industrial life, and, therefore, helped towards the sound solution of their problems," continued Mr. Willcox.

"Increased requirements for service of all kinds of utilities, inevitably resulting from industrial conditions, have forced public recognition of the fact that utilities are no longer either conveniences or luxuries, or merely private enterprises of interest only to their owners, but necessities for the public welfare, and the public is now realizing that these utilities must keep pace with the development of communities of the country.

"Under regulation which now prevails throughout the country the reward to capital invested in its utilities is limited to a fair and reasonable return. The large and speculative profits offered by unregulated enterprises being entirely eliminated, the money of speculators will not flow into public utilities. Only those seeking investments with limited return will provide the capital required, and those who are content with a limited return must also be assured of the safety of their principal and the certainty of the promised income. The public, therefore, in regulating its utilities has at the same time assumed responsibility for both protecting the capital invested in public service and assuring its reward in the form of interest and dividends.

"During the past year some of the conspicuous happenings tending towards the fixing of the status of public utility securities through better appreciation of the economic and financial principles involved have been the Federal Railroad Act of 1920, the Interstate Commerce decision raising freight and passenger rates on steam railroads, the Federal Water Power Act, the report

of the Federal Street Railways Commission, and the recent referendums of the Chamber of Commerce of the United States.

ADVANTAGES OF NEW WATER-POWER LAW.

"For many years the federal laws respecting the acquisition of title to water powers and water-power sites on navigable streams and on public lands, and the forest and other reserves, made the financing of such projects impossible. The Federal Water Power bill was finally passed by both houses of Congress and received the President's approval. The advantages of the new Federal Water Power law are, that it provides for the acquisition of title to water power sites in the form of 50-year permits upon declared conditions and revocable only by legal proceedings, and for repayment of the net investment if the license is not renewed.

"It remains to be seen whether the newly created water power commission will encourage or discourage the investors of the United States in the development of our water powers which are second to none in the world, and which under reasonable administration of the new water power laws would stimulate the conversion of our raw materials into finished products for home consumption and foreign trade.

"It is estimated that the railroads use 20% of all coal produced in the country; that coal alone represents more than one-third of the country's total freight; and that the mining and transportation of coal requires the labor of 1,500,000 men and the use of 1,000,000 freight cars and 40,000 locomotives.

"In its interim report No. 5, this committee discussed the inevitable expansion of the electric power industry and pointed out the greater economy in the generation and transmission of electric power necessary to meet the increased demand for energy, and that the interconnection of many central generating plants by combining reserve capacity makes available for use, and consequently production, about 25% of the investment in each plant, that proportion being ordinarily held as reserve in the case of breakdown.

"The financing of voluntary co-ordinated superpower systems should prove most interesting. The solidarity of the industry, the certainty of market, the diversity of uses, are all factors of sound security issues, and it is inevitable that the electric generating and transmission systems will, like the railroads, combine and recombine in larger systems, creating stronger and sounder enterprises requiring large and constantly increasing amount of capital. The responsibility of directing the building up of these great industrial institutions into sound corporate structures, soundly financed with adequate provisions for expansion, rests largely upon the investment bankers.

"The Federal Electric Railways Commission has submitted a most interesting report which has received the high commendation of the President.

"In the past few years many utilities have realized the wisdom of selling their securities among their customers and patrons and upwards of $100,000,000 of utility securities have been purchased by local investors since the outbreak of the war. One organization announces that since it started to build up home ownership in 1915, there have been more than 24,000 local sales aggregating upwards of $13,000,000 par value of the preferred stock of electric and gas companies, the average investment approximating $540. This practice of local utility security distribution is encouraged by bankers. Making the public responsible to the extent of the local distribution for the fair treatment and the prosperity and success of the enterprise encourages thrift and affords an investment opportunity not usually open to small investors.

"It is obvious from their history that no utility is like a farm or a hotel, the purchase or development of which can be fully financed by a present issue of fixed obligations of a limited amount. Utilities must grow and if their growth is hampered by inability to finance, disaster may overtake them. There should be more owners and fewer creditors. The ideal utility financial structure should admit of the sale of common stocks which, of course, is only possible if these stocks, unsecured by lien or preference, are protected by property values and by earnings sufficient to represent a reasonable business risk with some expectation of more than ordinary profit.

"The public utility situation is distinctly encouraging. The functions of public service are better understood, their financial problems are recognized and are being solved. The critical observer cannot escape the just conclusion that the public in limiting the rate of return on utility investments has become responsible for a fair return. The events of the year have confirmed the conclusions of those operators and regulators who have pointed out that the most efficient utility is the prosperous utility. The demand for the great expansion of all public utility service comes not from the owners and operators but from the public. It is not too much to say that public regulation of utilities in the United States has reached a point where its principal function is recognized to be the provision of adequate public service through just rates sufficient to attract the capital needed for their expansion."

COMING CONVENTIONS.

American Electric Railway Association. Annual convention, Atlantic City, N. J., Oct. 11-15.

National Association of Electrical Inspectors. Annual meeting, Philadelphia, Oct. 12-13. Secretary, W. L. Smith, Concord, Mass.

International Association of Municipal Electricians. Annual convention, New Orleans, La., Oct. 19-22. Secretary, Clarence R. George, Houston, Tex.

Association of Railway Electrical Engineers. Annual convention, Chicago, Oct. 28-30.

National Association of Railway and Utilities Commissioners. Annual convention in the board room of the Interstate Commerce Commission, Washington, D. C., Nov. 9-12.

American Institute of Electrical Engineers. Meeting in Chicago Nov. 12 under auspices of the Protective Devices Committee. Secretary, F. L. Hutchinson, 33 West 39th street, New York City.

Electric Power Club. Fall meeting. Hot Springs, Va., Nov. 15-18. Headquarters, Homestead Hotel. Secretary, C. H. Roth, Adams and Loomis streets, Chicago.

Southeastern Geographic Division of the National Electric Light Association. Annual convention, Miami, Fla., Nov. 17-19. Secretary, Charles A. Collier, Atlanta, Ga.

CONTRACTOR-DEALER

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Store-keeping for the Dealer in Electrical Goods

SUGGESTION FOR FIXTURE ROOM IN ELECTRICAL STORE.

In the wholesale electrical supply house of the Alexander M. Kailing Co., in Milwaukee, there is a lighting fixture salesroom that offers a suggestion to retail electrical dealers. This fixture room is partitioned off at one side of the stockroom, in the rear of the main salesroom. Its chief feature is the entrance, which is built to represent a diminutive entrance to a colonial residence. There is the typical lantern of the period hanging above the doorway, which is flanked by panelled windows. Burned into a wooden panel fastened to the shingles above the door is the sign, "Ye Fixture Shop." Within the long, narrow room the fixtures are suspended from the low ceiling, brackets are fixed along the walls and portable lamps are displayed on long, narrow tables. The woodwork in the fixture room is finished in old mission, the dark tone serving to set off the different types of fixtures and bowls on display. This company manufactures its own fixtures.

FIXTURE MANUFACTURER AWARDS PRIZES IN LETTER CONTEST.

Freeport (Ill.) Electrical Dealer Wins First Honors in Sales-Story Contest With Description of Method of Making Fixture Sale.

Recently the Beardslee Chandelier Manufacturing Co. inaugurated a contest among dealers in "Denzar" lighting fixtures, the awards to be made to those electrical dealers writing the best letters descriptive of their experience in closing a sale of the particular fixtures produced by this manufacturer. The first honor in the contest was accorded Kenneth K. Ridgway, sales manager for the Ridgway Electric Co., Freeport, Ill.

This Installation of "Denzar" Lighting Units Is Described in the Prize-Winning Letter From a Freeport (Ill.) Dealer.

Winner of the second prize was F. A. C. Tocque, of the Burdorf Co., Louisville, Ky., and of the third prize, E. O. Kummer, of the Kummer Electric Co., Bloomington, Ill.

Mr. Ridgway's letter, which was accorded first prize in the "Denzar" contest, was as follows:

> Several weeks ago the writer was called to figure on some changes in electrical work for a furniture dealer. He noticed some old-style lighting units in use and suggested the installation of some modern ones. The owner, however, only laughed and said he guessed they were not yet worn out.
>
> About a week later we received a shipment of ceiling-type, 100-watt "Denzars." The writer immediately set one up, attached a cord and called upon the furniture man. Actually, the 100-watt "Denzar" gave more light than the 200-watt inverted-bowl unit then in use.
>
> Well, what could the furniture man say? By pointing out to him a lot of dust and a dozen bugs in each of his units, and by showing him how the "Denzar" was bug-proof, we made him consent to talk business.
>
> A study of the conditions showed that eight 400-watt "Denzars" would do the work. By putting it all down in black and white the furniture man soon saw that he could get more and better light, a dust and bug-proof unit—one that would add to the attractiveness of his store—and come out even on his investment. He gave us the order and today he is more than willing to allow us to bring our customers to his store, and even puts in a few good words for us. He is really sold on the new unit because he knows what it will do.

Other winners in the contest were Henry L. Ley, State Electric Co., Canton, O.; Louis H. Dieke, Hinsdale, Ill.; Lucile Dietz, Monroe Electric Co., Monroe, Wis.; William A. Smith, Jr., Frontenac, Kans.; Flaugher Bros., Huntington, Ind.; W. F. Santisteban, Columbus, Ind.; Harry G. Thomas, Sterling, Ill.; A. G. Phillips, Caney Electric Co., Caney, Kans.; F. G. Burdorf, Burdorf Co., Louisville, Ky., and W. F. Fricke, Camp Point, Ill.

Honorable mention was accorded letters from W. O. Yagerline, Hatfield Electric Co., Indianapolis, Ind.; J. W. Summers, Yankton, S. D.; J. H. Blethen, New Hampton, Ia.; J. Q. Carpenter, Plainview, Minn.; J. P. House, Greusel-Quarfot Electric Co., Milwaukee; Grisdale & Baugh, Lake Placid, N. Y.; E. W. Steinbeck, Kasson, Minn.; John B. Tingley, Tingley Electric Co., Green Bay, Wis.; H. W. Tucker, Ocala, Fla.; C. E. Jett, electrical department of Anderson & Veatch, Evansville, Ind.; D. P. Johnson & Sons, Republic, Kans., and Frank W. Mack, Manson Electric Contracting Co., Manson, Ia.

This is not the first dealers' contest arranged by this manufacturer, nor is it expected to be the last. The dealers handling this line of lighting fixtures are receiving stimulating "helps" from the jobber and manufacturer at a time when all lines of lighting fixtures are beginning to feel the effects of a beneficial awakening.

Business Hints for the Dealer

How Organization Assists Retail Electrical Dealers—Where Trade Journals Also Help—Display Windows as Sales Makers

Chief among the reasons for the rapid advancement of the electrical contractor-dealer, indicated by the many modern retail stores that have sprung into existence during the past two years, is the co-operative spirit fostered by organization. The national, state, sectional or district and city associations of electrical contractors and dealers, the Society for Electrical Development and kindred organizations are doing valuable work in developing and perfecting modern systems of electrical contracting and the selling of electrical appliances.

Before the existence of these associations the electrical contractor knew little of the business ways of his fellow craftsman, and appeared to care less. He looked upon other contractors as more or less antagonistic competitors and kept his own ideas and plans to himself. What information he obtained regarding the methods of other contractors was obtained more or less surreptitiously. As to the merchandising of electrical appliances in connection with his contracting business, he sometimes went so far as to act as agent for some few appliances and lighting fixtures, carrying his catalogs and price lists about with him on the wiring jobs.

With the advent of organization, however, each contractor found that the other was a regular fellow, and once the ice of doubt and antagonism was broken so that the craft of fellowship and co-operation could navigate, they began to sail toward more profitable shores and broader business views. And, above all, they found that this fellowship of organization developed more business and greater talent to handle it. Thus, the germ from which has developed the present great and constantly growing business of retailing electrical appliances in connection with electrical contracting is the interchange of ideas and methods. It is not a new germ but it is one of the best that modern business ever set out to cultivate.

Benefits of Close Perusal of the Modern Trade Journal.

One of the few inexpensive benefits available to the electrical contractor-dealer today is the modern electrical journal. For the expenditure of a very few dollars he may obtain valuable information regarding the latest developments in the industry, not only in merchandising and contracting, but in other related branches which the wise contractor-dealer finds it well worth his time to acquire. Just as organization broadens his views, so does the study of articles compiled and printed in electrical trade journals furnish him that information which would otherwise have to be obtained in schools at much greater expenditure of money and valuable time.

One such journal coming regularly to the office or store is better than none at all, but several such journals, if properly perused, prevent narrowness of vision and furnish the reader with the broadest possible knowledge of and insight into current developments in his business. A great many dollars are expended to make these journals clear, concise and accurate textbooks of the industry and the best value is to be obtained from them by reading them as soon as they arrive. During the first reading articles and excerpts should be marked for future reference. Many dealers preserve all copies of their trade journals in files with a reference index of articles and items to which they may wish to refer later. To let these journals lie on the desk or table unread, or to destroy or throw them into the waste basket after the first reading is a waste of money and opportunity. Your trade journal is a true business builder.

What Is the Value of Your Show Window as a Sales Maker?

It has been found by the research department of the Westinghouse Electric & Manufacturing Co. that department stores value their show windows at $35 to $50 a day. The window of the contractor-dealer can easily be made as valuable to him. Dealers know how impossible it is to trim a display effectively if the show window is poorly constructed for display purposes.

The first consideration should be to have the window altered or remodeled so that it can be readily adapted to numerous displays of appliances, fixtures and supplies. Whatever the cost, it is more than repaid in a very short time by the added value in attractiveness. Some dealers say that a show window, to lend itself to attractive dressing and appropriate display, should not be more than 8 to 10 ft. high and 6 to 8 ft. deep. Tall windows and those that are open or overly deep may be readily adapted by inclosing with paneled beaverboard or curtains for back and sides, and a valance or paneled sign across the upper portion of the glass.

One dealer in Chicago whose store front was very narrow, the entrance taking up approximately half of the front, remodeled his show windows so they extended 12 ft. into the store on either side of the entrance. He then dressed the displays to show upon the deep entrance rather than onto the street. By this arrangement he had 18 ft. of show window on either side of the entrance—a total of 36 ft.—where the original windows were but 6 ft. wide, or a total of 12 ft. The new arrangement attracted crowds of people, especially at night when the lights were on, and they would walk into the entrance to obtain a more complete view of the entire setting.

Given an appropriately proportioned window, with the best possible dressing of the display, there is still another essential required to give it the best possible value. It must be properly illuminated. The lights must be arranged so that they do not shine directly into the eyes of the observer or reflect from polished surfaces.

At the same time they should bring out every particular of the display distinctly. It has been said that a properly trimmed and illuminated show window will pay the rent. Some windows in some locations are doing even more.

Necessity for a Good Store Accounting System.

Failure to keep books has resulted in more business deaths among contractor-dealers in the past two years than any other cause. Without a proper accounting system the contractor-dealer is like one who sleeps in the shadow of an active volcano; disaster is likely to come without warning at any time. Since standard accounting systems for contractors and dealers may now be had from various sources, there would seem little excuse for one who is not fortified against the dire possibilities contingent on lack of adequate knowledge of his business.

Every well-equipped electrical store now has a complete set of accounting blanks, included in which are daily statements, trial balances, cash received, cash paid, journal, voucher disbursement sheets, sales recapitulation sheets, accounts receivable, accounts payable, material summary sheets, returned material records, requisitions for material, job reports and envelopes, and time cards.

When the contractor-dealer can tell at the end of every day just how his business stands—how much stock on hand, how much he owes and how much his average daily sales are—he can place his orders intelligently and conduct his business from day to day with that confidence born of accurate knowledge. By his books he can tell where to look for and stop leaks, when and where to push ahead and when and where to retrench. He will know how to charge up that usually intangible "overhead," to figure in his own time as manager of the business, to allow for depreciation in equipment and many other items that work unseen depletion of the profits.

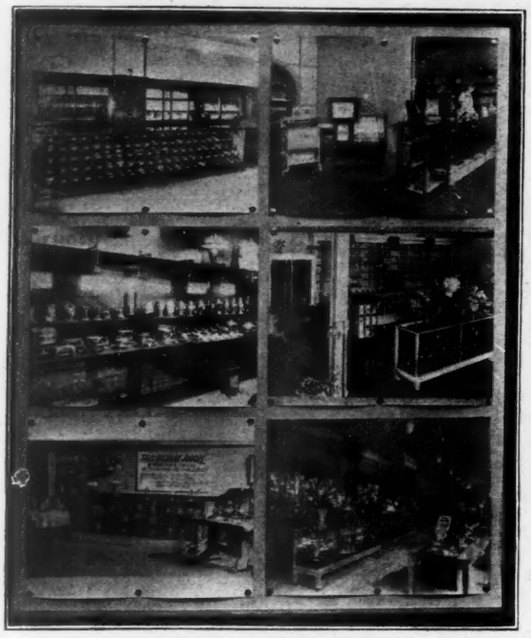
COUNTER AND SHOWCASE DISPLAYS FOR ELECTRICAL STORES.

Westinghouse "Better Merchandising Shows" Benefit Many Contractor-Dealers Who Visit Them and Learn Modern Store Arrangement.

Of timely benefit to many contractor-dealers is the opportunity afforded by the "Better Merchandising Shows," which the Westinghouse interests are staging in the large business centers throughout the country. These shows, which cover every phase of electrical contracting and merchandising of appliances, fixtures and supplies, was more fully described and illustrated in the Sept. 25 issue of Electrical Review.

In addition to the demonstration of selling methods in which actual appliances are used, those in charge of the shows invite attention to displays of enlarged photographs illustrating store arrangements and window displays. The illustration herewith shows one of the photographic displays used to indicate proper methods of arranging displays of merchandise in showcases and on counters. Correct and incorrect methods of illumination of the interior of the store are also shown.

In the upper lefthand corner of the illustration is shown an electrical supply department which consists of a neatly arranged display rack with shelves in the rear for larger supplies. Each compartment in the rack is labeled and the rack is so lighted as to show every detail clearly. In the upper righthand corner is an arrangement of glass counters forming an alcove for the display of larger appliances. In the left center is an arrangement of shelves and showcases for the display of small appliances. In the right center is another showcase arrangement permitting a view from all sides. In the lower lefthand corner is shown a model display room, while in the lower righthand corner is a salesroom showing the arrangement of display tables in the center of the floor, a row of glass showcases along one side near the counter, and glass inclosed wall cases back of the counter.



-Designs for Counter and Showcase Displays of Electrical Goods as Demonstrated in Westinghouse "Better Merchandising Shows."

Before these shows have completed the rounds of the cities they will have been visited by hundreds of electrical dealers and will have accomplished much for the improvement of conditions governing the retailing of electrical goods.

DISPLAYING LIGHTING FIXTURES IN LARGE BOOTHS.

One of the variations from the usual style of showing lighting fixtures is to be found in the display room of the American Electric Co., of Milwaukee. This company very successfully specializes in the sale and installation of fixtures and more than half of the store is taken up with six large display booths. The partitions of the booths are low and are covered with false ceilings. The interior of each booth is painted black to better facilitate the demonstration of the fixtures and bowls. Shelves around the sides in each booth contain bowls and portable lamps. Each fixture and bowl is wired for individual demonstration.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

CAPITAL STOCK SALE TO EMPLOYES AND CUSTOMERS.

Drive for Commonwealth Edison Co. Stock Results in 20,987 Shares Being Sold—Purpose of Distribution Outlined.

The drive for the capital stock sale of the Commonwealth Edison Co., Chicago, to employes and customers started Sept. 18 and closed Sept. 25. During that period 20,987 shares were sold, which is claimed to be a record for a campaign of this nature. About 60% of the sales were on a cash basis, the balance on the deferred-payment plan. To give an idea of the rapidity with which the shares were absorbed it might be stated that the stock which it took the Commonwealth Edison Co. a year to acquire was disposed of in a week.

The purpose of this stock distribution may be summarized by stating that the Commonwealth Edison Co. is a Chicago institution and from its very nature as a producer of a commodity essential to community life it follows that the company should be operated and owned by residents of Chicago. Accordingly, the purpose of the sale was not to obtain funds for extensions and additions, but to effect a wider, a more popular distribution of stock among employes and customer-residents of the area in which the company operates. The company functions best, it is believed, when served by loyal, stockholding employes and when serving customers who participate in its earnings and have a voice in its management and policies. Customer-ownership is a matter of definite mutual advantage. Growing public realization of this interdependence, combined with the esprit de corps of the Commonwealth Edison organization, assured a speedy sale of this attractive stock issue.

The timeliness of this sale of stock is demonstrated by the following paragraph quoted from a recent report of an American statistician: "If we are correct in our premise that the inflationary situation now existing is approximately at its turning point, and that we can look forward over a series of years to declining commodity prices; in other words, to an absolute change in fundamental conditions, we should change our investment attitude. We should consider only securities that will be benefited by that change in conditions. We now direct everyone's attention to the change that is taking place in the conditions underlying public utility issues. We strongly recommend these issues at the present time, many of which are selling at low prices, and which seem to offer one of the most attractive possible forms of investment."

The organization handling the sales of the Commonwealth Edison stock comprised 50 captains appointed by the investment department, each captain leading a team of ten men picked by himself. All of the salesmen are employes of the company and conducted the sale of stock outside of business hours. Fred H. Scheel, manager of the investment department, had general charge of the sale.

The growth of the Commonwealth Edison Co. has been remarkable. Organized in 1883 as the Western Edison Light Co., it was the pioneer in the electric utility business in Chicago. In 1887 came reorganization under the name of The Chicago Edison Co., and in 1888 the name was changed again to Chicago Edison Co., under which name the company operated until September, 1907, when it was consolidated with the Commonwealth Electric Co., taking the present name of Commonwealth Edison Co. In October, 1913, came further enlargement as a result of the inclusion of the Cosmopolitan Electric Co. So enormous has been the growth of the company business from year to year that the investment of $500,000 in 1887 had swelled in 1919 to an investment of approximately $115,000,000. Tremendous as this progress has been, however, it is estimated that when the company's field will have attained its full development the investment will have been augmented to several times the present sum.

STOCKHOLDERS' INTEREST IN PUBLIC UTILITY OPERATIONS.

Pacific Gas & Electric Co. to Distribute House Organ to Stockholders and Keep Them in Touch With Company's Activities.

The Pacific Gas & Electric Co., San Francisco, Cal., publishes monthly the *Pacific Service Magazine* in the interests of its employes. Commencing with the August issue the company decided to send the magazine regularly to its stockholders. In taking this step the management states that it is actuated by a desire to do all in its power to establish and maintain that intimate relationship which should exist between the stockholder, as a part owner in the public utility enterprise, and the directors and officers of that enterprise, who are really the servants of the stcokholders. There are two classes of public utility securities, viz., bonds and stocks, and there is as much difference between a bondholder and a stockholder as there is between any commercial house and the bank from which it borrows money, for the bondholder is a creditor of the enterprise to whom the stockholders owe money. In that lies the difference, and thus it can be readily seen that the respective interests of bondholder and stockholder may be wide apart and should be viewed from totally different standpoints.

As long as the bondholder receives the interest which falls due upon his holdings from time to

time and recovers his principal at each bond's maturity, and as long as he knows that the company is efficiently managed in the way of maintaining its properties, which are security for his bonds, in good condition, he has no further interest in the enterprise. If the company is very prosperous he receives no direct benefit from that increased prosperity other than a possible slight advance in the value of his bonds arising from the increased credit and security of a prosperous business.

On the other hand, the stockholder is the real owner of the company. Its prosperity is his benefit; its poverty his loss. If the company, supposing it to be a public utility and as such subject to the jurisdiction of a rate-making body, is allowed adequate rates for the operation and upkeep of its property, the payment of interest on its indebtedness and the maintenance of a sinking fund to retire that indebtedness at the proper time and leave a comfortable surplus to be divided among the stockholders each in proportion to his holdings, then that stockholder's interest increases in value. The company is able to obtain money at reasonable rates from the people of the bondholder class to develop and increase its business and to increase its earnings thereby. But if the rates charged by the utility for its commodity should be reduced to a point where the enterprise itself is just kept alive so that it cannot obtain money at all for development purposes or in any event is compelled to pay a prohibitive rate for that money, the amount to be divided among the stockholders becomes jeopardized and the value of the stockholder's interest in the enterprise decreases greatly.

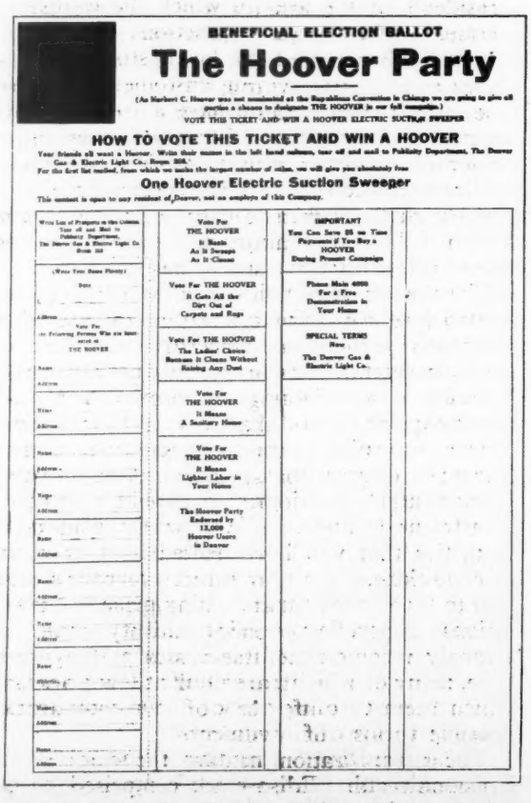
Duty of the Stockholder to Sustain Utility Projects.

Now, the statement proceeds, take a public utility such as the Pacific Gas & Electric Co. It is safe to say that the day of cheap fuel oil is over. The people of California must operate their industries by hydroelectric power and must do their heating, for the most part, by gas. Both these products then must be developed to the utmost limit if the state of California is to progress as she is entitled to progress by reason of her unusual climatic conditions and the natural resources at her command. It stands to reason then that the number of bondholders and stockholders in the various public utilities of the state must be greatly increased, and this can only be done if the companies are allowed to earn an adequate return upon their investment. The time has come when the people of California should realize to the full the responsibility upon them to support, actively and generously, the public utilities operating in their midst. With this they should understand that only through being allowed to earn a fair return upon the investment can these utilities be made to operate successfully. It is far more important to everybody in the state of California that these utilities should be developed to their utmost than that their patrons should obtain some slight reduction of their electric light, power and gas bills.

It is the duty of the stockholder, therefore, as a part owner in the utility, to do his share in impressing this sense of responsibility upon the people around him. It is the duty of the stockholder, yes, and of the consumer, to have this idea constantly before him and for his part to see that the public utilities are properly sustained in order that they may be enabled to develop the necessary supply of the commodities so sorely needed at this time of unusual progress and advancement in every field of industrial and commercial endeavor. So, in order that the stockholders of "Pacific Service" may be properly informed at all times as to the condition of the company, of which they are the owners, of what the company is doing to supply the demands of the people; how it is developing; in what condition are its properties; what is being done in the way of additions and betterments—briefly, in order that the directors and officers of the company, as trustees for the stockholders, may be enabled to make open record of their stewardship, *Pacific Service Magazine*, as the house organ of "Pacific Service," will be mailed to its stockholders every month from now on.

ELECTRIC SWEEPER SALES CONTEST.

The Denver Gas & Electric Light Co., Denver, Colo., has inaugurated a novel contest for the purpose of furthering the sales of the Hoover electric suction sweeper. The idea is to have each person entering the contest fill out the name of a prospective customer in the blank provided for that purpose in the left-hand column of the "beneficial election ballot," sample of which is reproduced on this page. Instructions are given as to tearing off and mailing the list of "prospects." The contest is open to any resident of Denver, not an employe of the electric company. A Hoover electric suction sweeper is offered to the person sending in the first list from which the largest number of sales are made.



BENEFICIAL ELECTION BALLOT

The Hoover Party

(As Herbert C. Hoover was not nominated at the Republican Convention in Chicago we are going to give all parties a chance to designate THE HOOVER in our fall campaign.)

VOTE THIS TICKET AND WIN A HOOVER ELECTRIC SUCTION SWEEPER

HOW TO VOTE THIS TICKET AND WIN A HOOVER

Your friends all want a Hoover. Write their names in the left hand column, tear off and mail to Publicity Department, The Denver Gas & Electric Light Co., Room 308.

For the first list mailed, from which we make the largest number of sales, we will give you absolutely free

One Hoover Electric Suction Sweeper

This contest is open to any resident of Denver, not an employe of this Company.

Write List of Prospects in this Column. Tear off and Mail to Publicity Department, The Denver Gas & Electric Light Co. Room 308

Vote For THE HOOVER It Suits As It Sweeps As It Cleans

IMPORTANT You Can Save $5 on Time Payments if You Buy a HOOVER During Present Campaign

(Write Your Name Plainly)

Vote For THE HOOVER It Gets All the Dirt Out of Carpets and Rugs

Phone Main 4000 For a Free Demonstration in Your Home

Vote For the Following Persons Who are Interested in THE HOOVER

Vote For THE HOOVER The Ladies' Choice Because It Cleans Without Raising Any Dust

SPECIAL TERMS Now The Denver Gas & Electric Light Co.

Vote For THE HOOVER It Means A Sanitary Home

Vote For THE HOOVER It Means Lighter Labor in Your Home

The Hoover Party Endorsed by 13,000 Hoover Users in Denver

Sample Ballot of the "Hoover Electric Suction Sweeper Party."

QUESTIONS AND ANSWERS

All Readers Are Invited to Submit Contributions on Electrical Matters to This Department—Answers Should Be Sent Within Eight Days of Date of Publication of Question—Payment Will Be Made for All Answers Published

Questions.

No. 497.—USE OF REACTORS ON TRANSMISSION LINES.—What are the factors which govern the size of a reactor that should be installed on a transmission cable to give protection from gounds? Do reactors that are suitable for protection against short-circuits give the same degree of protection against grounds? Are reactors essential or useful on well constructed overhead lines? Can overload relays be safely eliminated on lines that are properly protected by reactors?—A. B. R., Peoria, Ill.

No. 499.—ILLUMINATION IN A BARBER SHOP.—What intensity of illumination should be provided for the working positions in a barber shop? What is the best method of securing the proper illumination in a manner that will not cause discomfort to the person in the chair or to the barber?—N. O. C., Detroit, Mich.

No. 504.—CONTROLLING MOTOR FROM TWO LOCATIONS.—I have a 5-hp., induction motor which is started from half-taps on a three-phase transformer bank by means of a three-pole, double-throw switch. Will someone please show how such a motor can be started and stopped from two different locations?—N. W. C., Denver, Colo.

No. 505.—ENERGY REQUIRED TO HEAT WATER.—I am considering installing an electric water heater in my home and would like to know what amount of energy it will consume. Will someone who has had experience with heaters kindly advise me as to how many kw-hrs. per month are required to heat water for a family of three?

Is a tank heater more economical than an instantaneous faucet heater? Can a tank heater be connected to the ordinary house circuits, or will special connections have to be made?—J. E. R., Chicago.

Answers.

No. 495.—SYNCHRONOUS MOTOR AS A CONDENSER.—Will someone please explain for me just how it is that a synchronous motor acts like a condenser? I have read any number of articles on the use of motors as condensers, but have never had a clear explanation given as to how such an effect is produced.—R. H. N., Peoria, Ill.

Answer.—When an electromotive force is impressed across a condenser it takes a current which leads the voltage by 90 electrical degrees; that is, the current wave is so related to the voltage wave, with respect to time, that the current wave reaches its maximum value 90 deg. ahead of the maximum value of the voltage wave. This phase difference is only approximately realized in practice owing to the resistance in the condenser connections which reduces the difference to some value less than 90 deg.

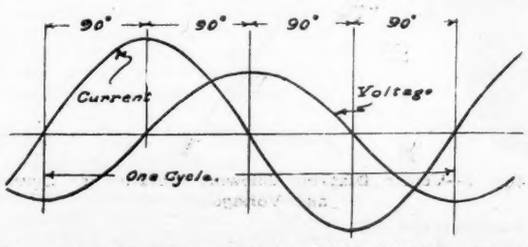


Diagram Showing Current Wave Leading Voltage Wave.

One of the characteristics of a synchronous motor is that it may be made to operate with a lagging or leading current, or at unity power-factor by suitably varying the excitation of the field. If the field is weak, the motor will take a lagging current, and if strong the motor will take a leading current. The stronger the field the more the current wave will lead the voltage wave. The synchronous motor therefore produces the same effect in the circuit as a condenser. When a synchronous motor is intended for such use it is constructed with especially heavy field windings to carry the large exciting current without overheating.—H. S. R., Wahpeton, N. D.

Answer.—Altering the field strength of a synchronous motor causes a variation of power-factor, overexcitation causing a leading component and underexcitation causing a lagging component of current. When the field strength is altered only a momentary speed variation is noticeable because the motor, being synchronous, must run at the same speed as the alternator driving it. Since the alteration of the field strength does not alter the speed, such alteration must manifest itself in a phase difference between current and voltage. If excitation is too weak, a lagging component is caused because the voltage of the motor is lower than that of the supply and, consequently, the missing magnetization has to be supplied from an outside source. Exactly the reverse is the case when the motor field is overexcited.—J. S., Cumberland, B. C.

No. 496.—METER FOR RECTIFIED CURRENT.—What kind or type of ammeter should be used to measure accurately the current delivered on the d-c. side of a mercury-arc rectifier?—H. R. G., Houston, Tex.

Answer.—Electric currents may be measured in accordance with several laws, and on currents which do not maintain a continuous value the measurements will have discrepancies which may vary through a wide range. Instruments of the permanent-magnet or d'Arsonval type measure the average value of the current, and on an alternating current will give a zero indication because the average value of that current is zero. Instruments of the electrodynamic, moving-iron and hot-wire types indicate the square root of the mean-square value of the current, and will indicate either an alternating or direct current. Meters of the induction type measure the alternating component only and give no indication on direct current. Their indications agree substantially with those of an instrument of the second class when fed through a current transformer.

A rectified current may be looked upon as a mixture of alternating and direct current, the

alternating component, if derived from a single-phase source, being of a distorted wave form and having a frequency double that of the supply. On a pure alternating current, rectified at the zero point of the wave, an electrodynamic ammeter would agree in its indications with the current on the a-c. end, while a d'Arsonval instrument would read this value divided by 1.11. An induction type of meter connected in the rectified circuit would give an indication of approximately one-half the original value. As soon as the wave departs from the true sine form, or when rectification is not perfect or takes place at other than the zero point, these relations no longer hold good. A peaked supply wave would tend to lessen the reading of the permanent-magnet instrument, and any departure of rectification from the zero point of the wave would have a similar effect.

In the measurement of rectified currents, therefore, the selection of an instrument would be governed by the purpose for which the current is to be used. If the current is to be used directly for heating or for lighting, its measurement should be made with an instrument of the electrodynamic or of the magnetic-vane type. Such an instrument would take account of the effects which the current would produce as an agent for heating or lighting. If, on the other hand, the current is to be utilized for battery charging, or for any other electrolytic work, it is only the unidirectional component that is used and d-c. instruments (d'Arsonval) should be employed.

The statements which have been made in regard to ammeters hold equally good for voltmeters. In the measurement of efficiency of rectifiers there is great room for controversy. A good rectifier utilizing both half-waves will, if electrodynamic instruments be used for the determination of its output, show an efficiency of nearly 100%, while if the output be measured with a d-c. voltmeter and ammeter a very much lower efficiency will be shown. It naturally follows that any statement regarding the efficiency of a rectifier must be made in a most guarded manner, and with a full consideration of the conditions under which the current is to be utilized and of the types of instruments used in the measurement of the electrical quantities.—P. A. B., Toronto, Ont.

No. 500.—Wattmeter Reading on Circuits of Low Power-Factor.—A description of the two-wattmeter method of testing a three-phase motor was given in the Aug. 21 issue of Electrical Review. It was stated in this article that it was fairly easy to show why one of the wattmeters reads negative at low power-factor. I would like to have someone explain or demonstrate this peculiar condition.—R. L. B., Racine, Wis.

Answer.—The reason for one of the wattmeters reading negative on low power-factor can best be explained by reference to Figs. 1 and 2. The vector diagram shown in Fig. 2 represents the currents and voltages shown in Fig. 1. The current A, in the wattmeter W, is the resultant of I_1 and I_2, and, since I_1 and I_2 are equal and 60 deg. apart, A is 30 deg. from I_1 and 30 minus θ deg. apart from E_1. Similarly, B is 30 plus θ deg. apart from E_2.

The reading of wattmeter No. 1 is designated by W_1, and that of wattmeter No. 2 by W_2. The sum of these two readings, or W_1 plus W_2, equals

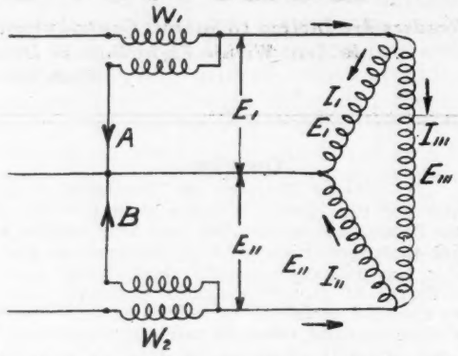


Fig. 1—Diagram Showing Circuits for Metering Three-Phase Load.

the total power in the circuit. The following relations are true:

$$W_1 = AE_1 \cos(30 - \theta)$$
$$W_2 = BE_2 \cos(30 + \theta)$$

On circuits of low power-factor, where θ is greater than 60 deg., W_2 is equal to BE_2 times the cosine of an angle greater than 90 deg. The cosine of an angle greater than 90 deg. is negative in value and, consequently, W_2 will be negative for such a condition. Where θ is just exactly 60 deg., W_2 becomes equal to BE_2 times the cosine of 90 deg. which is zero. Where θ is less than 60 deg. both readings are positive. Following are the designations of the various symbols used:

W_1 is the reading of wattmeter No. 1; W_2 is

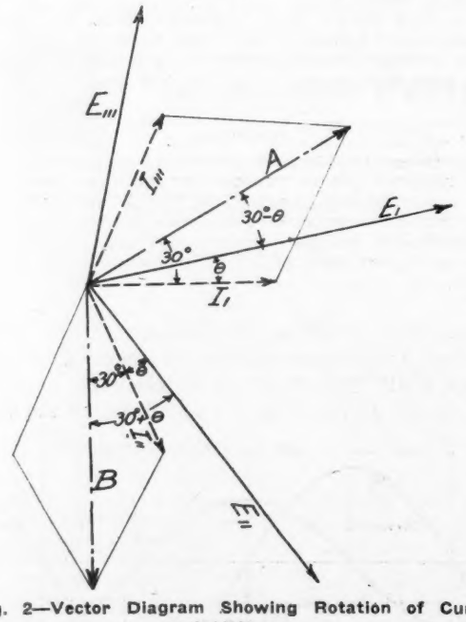


Fig. 2—Vector Diagram Showing Rotation of Current and Voltages.

the reading of wattmeter No. 2; A, A_1 and A_2 are the currents through wattmeters No. 1 and No 2; I_1, I_2 and I_3 are the currents in each phase of the load; E_1, E_2 and E_3 are the voltages across phases, and θ is the angle of lag between E_1 and I_1, E_2 and I_2 and between E_3 and I_3.—H. M. J., Schenectady, N. Y.

NEW APPLIANCES

Newly Developed and Improved Electrical and Mechanical Apparatus, Appliances, and Devices Now Being Placed on the Market

Fixture Suspensions Especially Adapted to "Phoenix" Units.

Among the fixture suspensions manufactured by the F. W. Wakefield Brass Co., Vermilion, O., is one known as the Wakefield "Red Spot" suspension which has been designed for especial use with the Ivanhoe "Phoenix" Unit 11-8-12. Purchasers are advised by the company

"Red Spot" Suspension Adapted to a "Phoenix" Unit.

that there is a saving in buying the glassware and suspensions separately.

These suspensions come in three sizes, each packed in a carton, convenient, safe, easy to stock and transport onto the job. These suspensions are also made for other units than the Phoenix. They are all made of heavy metal and carefully finished.

Motor-Driven Liquid Mixer.

A device for stirring chemicals and other liquids in the laboratory has been developed by the Central Scientific Co., 460 East Ohio street, Chicago. The device may be attached to any supporting stand, and the speed is variable from zero to 3000 r.p.m. It is made for 110 or 220-volt service, and may be had for either alternating or direct current.

Attachment Cord for Household Heating Appliances.

A portable appliance cord consisting of a separable fixture plug, 7 ft. of heater cord and an appliance plug has been placed on the market by the R. W. Lillie Corp., 30 Church street, New York City. Since the appliance plug is said to fit any of the household heating appliances, the cord can be used conveniently to supply a number of different electric devices and saves the use of several different cords. The cords with plugs attached and ready for service are packed in individual cartons. The fixture plug is made by Harvey Hubbell, Inc., the heater cord by Marlin-Rockwell Corp. and the appliance plug by T. & W. Manufacturing Co.

Color Hoods for Electric Signs.

For gaining color effects in electric displays, the Reynolds Electric Co., 2650 West Congress street, Chicago, has brought out colored-glass hoods designed to slip over a lamp to avoid the need of dipping. The hood is held in place by a spring fastener and is made in five colors, ruby, opal, amber, blue and green. Facility in attaching the hood, economy and lasting color qualities are the advantages claimed.

The All-in-One Commercial Lighting Unit.

This new lighting unit, which is being placed on the market by the Art Metal Manufacturing Co., Cleveland, is one of the most attractive which has been brought to attention recently. It is made with two styles

Art Metal Fixture With Spreading Chains.

of chain suspension as shown in the illustrations. Appearance, utility and efficiency are combined to a high degree in this new unit.

The "All-in-One" is made in two sizes, 150 to 200-watt, with 10-in. globe, and 300 to 500-watt with 12-in. globe. They are provided with a special porcelain reflector designed to avoid shadows or bright rings of light on walls or ceilings.

The unit is totally inclosed to preclude accumulation of dust, dirt, and vermin. A soft diffused light is dis-

Art Metal Fixture With Central Chain.

tributed to walls and ceiling while the concentration of light is projected downward to the working plane.

This fixture is an ideal one for banks, stores, offices, churches, schools, hotels and public buildings of every kind. Distribution will be made through jobbers and contractor-dealers.

Regulator and Indicator for Automobile Batteries.

To supply the need for a device to automatically protect the battery, generator and circuits against damage due to various causes, the Battery Appliance Corp., 1 East 49th street, New York City, has perfected the G. B. C. controller. This apparatus, according to the claims made, protects the entire electrical system of the car by automatically reducing the rate of charge to the battery when overcharging begins. It automatically prevents overheating of the battery, it protects all circuits against overvoltage which might blow out the fuses or burn out a generator armature or field, and, besides preventing and giving visible warning of these troubles, it also indicates when the elec-

trolyte level drops below a safe point.

As shown in the accompanying illustrations, this device employs three auxiliary electrodes which project through the ordinary cell caps so that the bottom of each electrode is just above the respective cell plate tops. Connec-

Front and Side Views of Regulator Mechanism.

tions are provided from these electrodes to the dash instrument, and other connections are made from the latter to the generator. The dash instrument is essentially a combination of three electromagnets which operate three signals; one marked "Low," another both "Low" and "Safe" and the third marked "Off." This latter signal indicates whether the battery is being charged or not; the "Off" signal indicates reduced generator output, while a blank space in the same window indicates normal charging.

Overcharging, one of the greatest battery evils, is prevented by controlling the temperature. The detail of operation is as follows: Three electrodes, one per cell, are connected by wires to the instrument on the dash. Safe level obtains as long as the electrodes are in contact with the electrolyte. If for any cause whatever the liquid in any cell of the battery falls out of contact with the electrode, the level indicator immediately flashes the sign "Low" on the instrument dial and the driver at once knows the cells need water.

The middle electrode is hollow and contains a small, rugged thermostat adjusted to expand a specific amount when the battery attains a temperature of 110 deg. F. If the battery suffers the beginning of an objectionable overcharge, the temperature reaches this limit and immediately the action of the

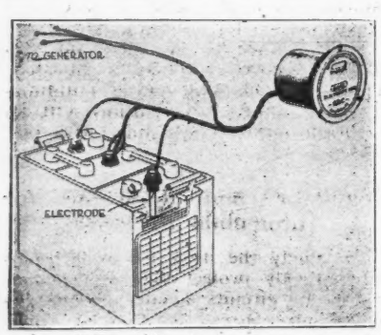


Diagram Showing Battery, Regulator and Generator Leads.

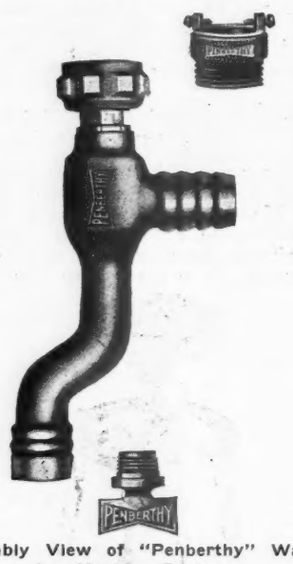
thermostat is conveyed by electrical leads to the instrument on the dash and it automatically changes the generator adjustment to reduce the charge. This causes the battery temperature to fall below 110 deg. F.

With this device installed, it is stated that the dangers due to loose, broken or corroded connections, or to high voltage resulting from overcharging or other causes, are eliminated. The controller adjusts the generator to deliver only the proper voltage. The device may be installed in any make of car, and is supplied complete with all needed wires, screws and new caps.

An Attachment for Filling and Draining Washers.

An attachment known as the "Penberthy" washing-machine drainer, for use in filling or draining washers, tubs and pails, is now being placed on the market by the Penberthy Injector Co., Detroit. It is simple in design and operation, being an application of the aspirating vacuum-pump principle. It is intended to eliminate the lifting and emptying of pails of water in either the process of filling the washer or draining and emptying it into the sink by hand. The device can also be used to drain sumps, cellars or other places where water accumulates.

By consulting the illustration it will be noted that the swivel is screwed onto the penstock or any water pipe, the fau-



Assembly View of "Penberthy" Washing Machine Drainer.

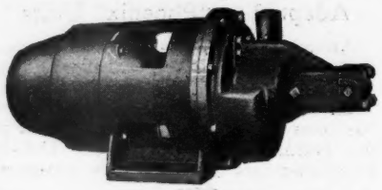
cet adapter being recommended where the faucet or pipe is not standard threaded. A piece of hose is attached to the side extension and run into the tub, pit or receptacle to be filled or emptied. If it is desired to discharge the drainage elsewhere than directly beneath the faucet another piece of hose is attached to the lower extension and is run to a sink or catch basin. When it is desired to fill the washer or other receptacle a cap is provided for closing the connection at the bottom and preventing the water from escaping into the sink.

Combination Oven and Fireless Cooker.

A 660-watt electric oven, developed to give lamp-socket cooking for the small-size family, embraces a fireless cooker, two radiant grills for broiling, etc., and a boiling device. A soapstone gives the fireless-cooker effect. Temperature is indicated by a thermometer on the outside of the oven door. The oven is white enameled and is trimmed with a rust-proof finish. The inside, which is of aluminum, is 12 in. deep, 16.5 in. long and 14.5 in. high. The walls, which are insulated, are 2.25 and 3 in. thick. Alternating or direct current at 110 volts may be used. The Home Helps Manufacturing Co., 39 West 38th street, New York City, is the maker of this oven.

Turbine-Generator Units for Locomotive Headlights.

Although developed especially for supplying energy for locomotive head-



View of Turbine-Generator Set Assembled.

lights, the turbine-generator units just placed upon the market by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., may be used for lighting service in small isolated steam plants such as pumping stations, small steam shovels, oil-well derricks and in other applications where a small amount of lighting is required. The construction is especially advantageous for portable application as it is designed for severe outdoor service.

This unit is small, light, compact and requires no foundations. It can be set up on a floor, heavy board or in any horizontal place and be held in position with four small bolts, studs or lag screws. While totally inclosed, all parts are readily accessible by removing the end cover on the generator and the turbine end casing on the steam unit. The five moving parts of this set are the shaft carrying the generator armature and the turbine rotor, two governor weights, the governor spindle and the governor steam-valve stem.

As there are no levers to wear and stick and no packing to adjust and renew, no adjustments are necessary after the unit leaves the factory. The unit is self-contained, each part being built for its particular duty as a part of a complete unit. The single shaft carrying the generator armature and turbine rotor with the governor is supported by two standard self-aligning ball-bearings at each end of the arma-

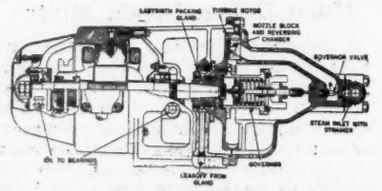


Diagram Showing Relation of Various Parts of Generator Set.

ture, the turbine rotor with governor being overhung.

The generator end of the unit consists of one casting containing one bearing and the field poles with their windings. To this is bolted the middle section, which carries the second bearing and holds one-half of the turbine rotor housing. This middle section supports the whole unit. The steam space, governor valve and steam strainer are contained in the third or turbine casting.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Landers, Frary & Clark, New Britain, Conn., has distributed a book of instructions for the care and use of the Universal electric vacuum cleaner.

Racine Electric Co., Racine, Wis., illustrates and describes in an eight-page folder the "Racine" line of electrical devices manufactured by that firm.

R. Thomas & Sons Co., Inc., East Liverpool, O., has issued a folder descriptive of the nail assembled porcelain knob manufactured by it for electrical wiring.

Metropolitan Electrical Products Co., 1250 Atlantic avenue, Brooklyn, N. Y., has issued a booklet setting forth the merits of the Metropolitan electric dishwasher manufactured by that concern.

Manufacturers Distributing Co., Inc., St. Louis, has issued a folder on the "Almetal" household steam laundry, describing the operation of this gas heated, electrically operated equipment designed for the home.

National Lamp Works of General Electric Co., Nela Park, Cleveland, has awarded a contract for the erection of its proposed new Buffalo works, to cost about $1,500,000, including machinery and equipment.

Grinnell Washing Machine Co., Grinnell, Ia., manufacturer of the "Laundry Queen" electric washing machine, describes in an illustrated folder the advantages to the housewife in using this labor-saving equipment.

Standard Underground Cable Co., Pittsburgh, is distributing bulletin 740-1 on joints and jointing materials for underground cable work. The pamphlet contains data on standard saturated paper jointing tubes, standard copper connectors and instructions for making joints.

The Electric Storage Battery Co., Philadelphia, has completed plans for the erection of a power plant at its new factory, Rising Sun lane and Adams road, to cost about $150,000. Plans have been filed for the erection of a three-story brick factory at this location, as an extension to other buildings.

Sprague Electric Works of General Electric Co., New York City, has issued bulletin 48961 describing Sprague electric type "W" hoists, with capacities of one to six tons for direct and alternating current. The bulletin gives specifications, cuts, dimensions and weights and shows a few uses for this equipment.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has issued leaflet No. 3461, which describes and illustrates its automatic current regulator for electric arc furnaces with movable electrodes. Schematic wiring diagrams and photographs of detailed parts of this apparatus are produced.

Steel City Electric Co., Columbia avenue, Pittsburgh, has filed plans for the construction of a one-story brick addition to its plant.

Griscom-Russell Co., 90 West street, New York City, manufacturer of heaters, evaporators, coolers, separators, etc., has issued bulletin 260 describing the Reilly water heater, which is largely used in the marine and stationary power plant fields.

S. O. S. Electric Sales Co., 2 Columbus Circle, New York City, has issued an illustrated folder describing the "Triplex" electric fan, which in combination with a powerful heater, with a nichrome element that blows a current of heated air, is claimed to be more effective than the ordinary reflector type electric heater.

General Electric Co., Schenectady, N. Y., has acquired the plant of the Schenectady Linolite Co., at Carmen, comprising a one-story works, 50 by 100 ft., with large acreage of land adjoining. Extensions and improvements will be made in the present building, and it will be equipped for the manufacture of silk and cotton insulation cords, wire and cable work, and other operations.

National Carbon Co., Inc., 30 East 42d street, New York City, has issued an 18-page booklet entitled "The Carbon Electrode," which contains a great deal of information for those interested in electric furnace operation for the manufacture of steel and ferro-alloys. Suggestions relative to the handling, storage and use of carbon electrodes, and a comprehensive bibliography are also given.

United Electric Co., Canton, O., has increased its capital stock from $500,000 to $1,000,000 for the purpose of enlarging its plant to take care of the increased volume of business. The company manufactures suction sweepers. The officers are: President, Edward Langenback; first vice-president, Harry R. Jones; second vice-president, A. A. Serva; secretary-treasurer, C. J. Adams; general manager, Fred Otte, Jr.

Benjamin Electric Manufacturing Co., 806 West Washington boulevard, Chicago, has recently issued an eight-page industrial lighting folder, bearing the title "Putting Across a Big Thought in a Big Way." It is addressed to the people who sell Benjamin products, the object of the circular being to post them of efforts put forth to drive home to industrial executives the many advantages of correct industrial illumination.

Copper Clad Steel Co., 30 Church street, New York City, is issuing a series of circulars covering various kinds of "Copperweld" wire, one of which relates to signal service. It is stated that signals can be just as effectively operated over a wire having a maximum resistance of 4.10 ohms. per 1000 ft., as at any lower resistance, therefore, No. 16 copper wire could be used for this purpose if it were not for the fact that the cost of maintaining such a line makes its use economically prohibitive. The same is also true of Nos. 14 and 12 copper wires, which do not have the required tensile strength to stand up well under sleet and wind loads. Maintenance, therefore, not conductivity, has set apart Nos. 10 and 8 as the smallest copper wires that can be economically used in signal service. The assertion is made that in signal service "Copperweld" is far superior to solid copper or any other kind of wire, both mechanically and economically, not as a substitute, but as a superior product. "Copperweld" wire gives signal circuits the strength of steel and the non-corrosive life of copper; it strengthens the whole pole line and minimizes signal failures. No. 10 "Copperweld" gives approximately the same strength as No. 8 copper wire, but is about 8 per cent lighter and costs materially less. In like manner, No. 8 "Copperweld" is more economical and just as efficient as No. 6 copper wire.

Edison Lamp Works of General Electric Co., Harrison, N. J., is distributing a four-page circular entitled, "A Short Path to Home Lighting Satisfaction—the Right Lamp in the Right Place." A chart is shown to simplify the selection of the proper lamp for every type of home lighting fixture, and also to enable the dealer to select the proper lamp for any lighting fixture in any size room, the fixtures illustrated in the chart being typical of those found in the average home.

Roller-Smith Co., 233 Broadway, New York City, manufacturer of electrical instruments, meters and circuit-breakers, announces the appointment of the Mountain States Machinery Co., (successor to the Vaughan Machinery Co.) 1710 Glenarm street, Denver, Colo., as its agent in the states of Colorado, Wyoming and New Mexico. In addition to the Roller-Smith lines the Mountain States company will handle the products of the Cutler-Hammer Manufacturing Co., Crocker-Wheeler Co., Maloney Electric Co. and the Terry Steam Turbine Co.

Hayes Electric Co., Detroit, has changed its name to the Hayes Home Appliances Co. The company states that it has always specialized in home appliances and the change was made to bring out that point and to avoid the impression that it does contracting or wiring, or handles chandeliers or fixtures. The company maintains stores in the following cities: 708 Genesee avenue, Saginaw, Mich.; 141 Pearl street, Grand Rapids, Mich.; 429 Detroit street, Flint, Mich., and 417 Madison avenue, Toledo, O., headquarters being located at 85 Broadway, Detroit.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

A. A. ADAMS has been appointed comptroller of the American Water Works & Electric Co., Inc., New York City.

RUSSELL G. CARTER has succeeded H. K. Brodgett as superintendent of the Belfast district of the Penobscot Bay Electric Co., Bucksport, Me.

J. F. FISHER, superintendent of the Oklahoma Gas & Electric Co., Drumright, Okla., has been elected adjutant to the local American Legion organization.

H. K. BRODGETT, formerly superintendent of the Belfast district of the Penobscot Bay Electric Co., Bucksport, Me., has been transferred to the Rockland district.

J. F. OWENS, manager of the Oklahoma Gas & Electric Co., Oklahoma City, Okla., has been elected an honorary member of the Capital Hill (Okla.) Chamber of Commerce.

O. L. MERKET, who has been connected with Westinghouse, Church, Kerr & Co., New York City, has resigned to become assistant chief engineer of the American Can Co.

FRED D. GORDON is now connected with the Cumberland County Power & Light Co., Portland, Me. He was formerly general manager of the Androscoggin Electric Co., Lewiston, Me.

DR. CLAYTON H. SHARP has been appointed chairman of the board of examiners of the American Institute of Electrical Engineers to succeed F. L. Rhodes. Dr. Sharp is technical director of the Electrical Testing Laboratories, New York City.

MARKHAM CHEEVER has been appointed chairman of the newly organized hydraulic power committee of the National Electric Light Association. He is chief engineer and general superintendent of the Utah Power & Light Co., Salt Lake City.

PHILLIP L. ROSE has been elected treasurer of the American Water Works & Electric Co., Inc., 50 Broad street, New York City, to succeed C. S. Ashdown who has resigned to become vice-president and comptroller of the Remington Typewriter Co.

F. V. MAGALHAES has been appointed chairman of the instruments and measurements committee of the American Institute of Electric Engineers to succeed S. G. Rhodes. Mr. Magalhaes is superintendent of the meter and test departments of the New York Edison Co.

F. N. LEONARD, of the Public Service Co. of Northern Illinois, Chicago, has been elected chairman of the Public Service Section of the National Electric Light Association. He is safety inspector and also secretary of the Central Committee on Co-operation of the Co-operative Council. Mr. Leonard served as secretary of the National Electric Light Association for two years.

TED WIEDMAN, who has been connected with the security sales department of the Sapulpa Electric Co., Sapulpa, Okla., has been transferred to the securities department of the Oklahoma Gas & Electric Co.

WILLIAM CREIGHTON PEET, chairman of the National Association of Electrical Contractors and Dealers, was born in New Orleans, La., Oct. 20, 1871. He attended the Massachusetts Institute of Technology and just before completing his third year of electrical engineering in 1893, he went abroad. After spending two years in the Technical School of Darmstadt, Germany, a

William Creighton Peet.

technical degree was awarded him. After graduation he was employed for two years with Schuckert & Co., Nuremberg, Germany, and then returned to America to accept a position in the engineering department of the American Telephone & Telegraph Co. In 1902 the engineering firm of Peet, McAnerney & Powers was formed, but upon the retirement of J. A. McAnerney in 1906, it became Peet & Powers, the name which is still retained today, with offices at 70 East 45th street, New York City. The firm has designed and constructed many electrical installations, among which may be mentioned the Times building, U. S. Custom House, Ward Bread Co. buildings, and the Scribner building, all in New York City. In Baltimore, the Union Station and the U. S. Custom House were two large undertakings. Mr. Peet, almost from the beginning of his business career, has been a member of the National Association of Electrical Contractors and Dealers. He has always been active in its affairs, holding many prominent positions in the local section and for the past three years chairman of the national body.

W. R. THOMPSON, of the engineering department of the Byllesby Engineering & Management Corp., has been appointed assistant general manager of the Shaffer Oil & Refining Co.

CHARLES S. RUFFNER has been elected chairman of the traction and transportation committee of the American Institute of Electrical Engineers to succeed W. S. Murray. Mr. Ruffner is vice-president of the North American Co., New York City, and vice-president of the A. I. E. E.

D. A. PIERCE has been appointed engineer of electrical distribution of the Public Service Co. of Northern Illinois, succeeding H. L. Caldwell, who has resigned to engage in other business in California. Mr. Pierce has been in the company's employ ten years and a little over a year ago was transferred from district "J" to the general office in Chicago.

CHARLES A. WESTMAN, who recently became associated with the Chicago sales organization of the Hart & Hegeman Manufacturing Co., manufacturer of switches, sockets, wiring devices, etc., has been appointed district representative for the company with headquarters in St. Louis, and will cover Missouri, Kansas, Nebraska and a portion of Iowa from that office. He succeeds S. B. Clapp in that territory, who has been assigned to the state of Ohio, with headquarters at Cleveland. Mr. Westman comes to the company with an experience gained in selling to the electrical and hardware dealers of New York state.

OBITUARY.

WILLIAM P. FEENEY, consulting engineer, 13 North LaSalle street, Chicago, died at his home, 4348 Washington boulevard, Sept. 30. He assisted Randolph Isham in the construction of the drainage canal.

WALTER NEFF, manager of the Dexter branch of the Missouri Public Utilities Co., died Sept. 27 as the result of shock and burns incurred in attempting to connect up electric light wires in a saw mill at Dudley, a short distance from Poplar Bluff, Mo.

L. D. YORK, president of the Portsmouth Street Railroad & Light Co., Portsmouth, O., died last month. He was born in England, Dec. 20, 1847. Mr. York was a member of the Engineers Club of New York and the American Society of Mechanical Engineers.

GEORGE A. CULLY, one of the veteran employes of the maintenance department, Edison Electric Illuminating Co. of Boston, died recently. He was born in Boston and started work with the company 22 years ago, being foreman of the low tension division at the time of his death. Mr. Cully was a member of the National Electric Light Association and the Edison Employes Club, and took an active interest in the affairs of these organizations.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES.

Lisbon Falls, Me.—The Worumbo Manufacturing Co. has awarded a contract to the Turner Construction Co., 178 Tremont street, Boston, for the erection of a two-story power house at its textile mills, to include steam and turbine departments.

Barton, Vt.—Wessell, Nickel & Gross, 457 West Forty-fifth street, New York City, manufacturer of player mechanisms for pianos, has awarded a contract to the Flynt Building & Construction Co., Palmer, Mass., for the erection of a power house at its proposed works at Barton. A large plant for woodworking, electrically operated, will be constructed.

Boston, Mass.—Considerable electrical equipment will be installed in the bank and office building to be erected by the Workingmen's Co-Operative Bank at 59-73 Cornhill street. The structure will be six and seven stories, and is estimated to cost $500,000.

Boston, Mass.—The Department of Public Works has completed plans for the erection of an additon to its power plant at the Lincoln Wharf, Commercial street, to cost about $70,000.

Cambridge, Mass.—A three-story power plant, 50 by 100 ft., will be erected by A. R. Hyde & Co., 430 Columbia street, in connection with the construction of an addition to its shoe factory, estimated to cost $75,000. Tuck & Gilman, 34 School Street, Boston, are the architects.

Everett, Mass.—The Boston Elevated Railway Co., 108 Massachusetts avenue, Boston, has plans under way for the erection of shops at Everett, estimated to cost $3,000,000, including machinery. Considerable electrical equipment for different phases of operation will be installed. Dwight P. Robinson & Co., 61 Broadway, New York City, is the engineer for the project.

Everett, Mass.—Electrical and mechanical equipment, including motors, etc., will be installed in the addition to be erected at the plant of the Boston Varnish Co., Second street. The structure will be one and three stories, 58 by 95 ft., and is estimated to cost $80,000. E. Locatelli & Co., Inc., 46 Cornhill street, Boston, is the building contractor.

Fall River, Mass.—The city council will call for bids at an early date for the erection of the proposed pumping plant for waterworks service to be constructed at Watuppa pond. The plant will be one-story, and with necessary dam construction will cost about $140,000. H. K. Barrows, 6 Beacon street, Boston, is engineer.

New Haven, Conn.—In connection with the new shop and yard additions at the Cedar Hill shops of the New York, New Haven & Hartford railroad, considerable electrical apparatus and machinery will be installed, including motors, industrial control apparatus, power equipment, etc. The new extensions are estimated to cost $225,000.

Norwich, Conn. — The United States Finishing Co., 320 Broadway, New York, has filed plans for the erection of the proposed power house at its factory in the Greenville district. It will be steel and concrete, 40 by 106 ft.

Terryville, Conn.—Plans are being completed for the erection of a power plant at the factory of the Eagle Lock Co.

Hamilton, N. Y.—The Water and Light Commission has plans under way for the construction of a municipal power house.

New York, N. Y.—The Radio Corp. of South America has filed notice of increase in capital from $10,000,000 to $11,000,000.

New York, N. Y.—The New York Telephone Co., 15 Dey street, has completed plans for extensions and improvements in its three-story exchange building at Herkimer and Sackman streets, Brooklyn, to cost about $70,000.

New York, N. Y.—Through William A. Read & Co., Nassau and Cedar streets, banker, the Cleveland Electric Illuminating Co., Cleveland, will dispose of a preferred stock issue totaling $4,000,000, the proceeds to be used for proposed extensions and improvements in electric power plants and system, financing, etc.

New York, N. Y.—The Ford Motor Co., Detroit, is having plans prepared by Stone & Webster, 120 Broadway, for the erection of its proposed motor tractor plant at Green Island, near Troy, N. Y.; the work will include the construction of a large hydroelectric power plant and is estimated to cost close to $2,000,000.

New York, N. Y.—Estimates made by the New York Telephone Co., 15 Dey street, call for new construction in the metropolitan district to total $26,000,000, during the present year. Under normal conditions, the work in this territory has averaged about $7,000,000 per annum.

Pine Plains, N. Y.—The Stissing Light & Power Co., recently organized with a capital of $25,000, is planning the operation of an electric light and power system in Dutchess and Columbia counties. Edward Bryan and F. E. Chase head the company.

Troy, N. Y.—The city council has preliminary plans under way for the erection of its proposed two-story power house on State street, to be used for engine department, centralizing control equipment and other general service.

Utica, N. Y.—Construction has been started by the Champlain Realty Co. of Utica on a pulpwood plant. Power will be furnished by electricity which will either be generated by the company or supplied by the Northern New York Utilities, Inc.

Camden, N. J.—John R. Evans & Co., Philadelphia, Pa., has filed plans for the erection of the proposed one-story addition to the power house at its local leather plant, 48 by 77 ft., at Second and Erie streets, to cost about $75,000.

Hoboken, N. J.—In connection with the proposed extensions and improvements to be made by the Delaware, Lackawanna & Western railroad, the local chamber of commerce has submitted a petition of recommendations, asking for the electrification of the company's lines for a distance of about 25 miles from the local terminal. In connection with yard betterments, it is recommended that an electric traveling crane be installed in the Ferry street yards, as well as electrically-operated haulers, and other similar equipment.

Newark, N. J.—Oscar Scherer & Brother, 115 Paris street, have filed plans for the erection of a one-story power house at their leather plant, 15 by 38 ft.

Pine Grove, N. J.—The E. I. duPont deNemours Co., Wilmington, Del., has completed plans for the erection of a steam operated power plant in this section to cost about $500,000, including machinery. It will be located in the Deep Water Point district.

Trenton, N. J.—The Crescent Insulated Wire & Cable Co., Muirheid Avenue, has completed plans for the erection of a one-story power house, 65 by 100 ft.

Allentown, Pa.—The city council is planning the installation of pumping equipment in its plant used for the waterworks department, located on the Little Lebanon river.

Camp Hill, Pa.—The Bell Telephone Co. has inaugurated work for the installation of an underground conduit system here. A number of overhead lines will be replaced.

Duncannon, Pa.—The question of issuing $20,000 in bonds to enlarge the municipal light plant will be submitted to a vote on Nov. 2. Address borough clerk.

Glen Rock, Pa.—The Glen Rock Electric Light & Power Co. has filed notice of increase in capital from $20,000 to $100,000 for proposed expansion.

Lebanon, Pa.—In connection with its proposed new local machine and locomotive shops, estimated to cost $135,000, the Bethlehem Steel Co., Bethlehem, Pa., will build a power plant for works service. Electrical

equipment will also be installed in other departments of the plant.

Philadelphia, Pa.—Plans have been filed by the Franklin Worsted Co., G and Vernango streets, for the erection of a one-story power house at its mill.

Philadelphia, Pa.—The American Brewing Co., Thirty-first and Master streets, has filed plans for the erection of extensions in its power house, to cost about $12,000.

Philadelphia, Pa.—Plans have been filed by the Orinoka Mills, Ruth, near Somerset street, for the erection of a one-story power plant, 50 by 117 ft., at Steiner and Jasper streets, to cost about $100,000, with equipment.

Philadelphia, Pa.—The Philadelphia Electric Co., Tenth and Chestnut streets, has arranged for a preferred stock issue totaling $6,000,000. The proceeds will be used for extension and betterment work of power plants and distributing system, including the completion of the electric generating plant, now in course of construction, at Beach and Palmer streets. This plant will have a total capacity of 60,000 kw., and is expected to be ready for service during the coming winter. Joseph B. McCall is president.

Philadelphia, Pa. — The William Cramp & Sons Ship & Engine Building Co., Richmond and Norris streets, has filed plans for the erection of a one-story addition to the power plant at its works.

York, Pa.—The York Railways Co. West Market street, has filed plans for the erection of a one-story substation of automatic operated type.

York, Pa.—The local water company is planning to equip its several pumping stations with electric power at a cost of $8000. The board of directors believes that this will bring about greater facility in supplying water and can be operated at less expense.

Baltimore, Md.—The Baltimore Dry Docks & Ship Building Co. has filed plans for the erection of a one-story electric substation to be located at the Key highway and Cross street.

Baltimore, Md.—Electrical and mechanical equipment, including ice-making and refrigerating apparatus, will be installed in the proposed plant addition to be erected by the American Ice Co. on Milton avenue. The extension is extimated to cost in excess of $150,000.

Frederick, Md.—The Board of Aldermen has received estimates of cost for the installation of equipment at the city power plant, with a new "white way" and general street-lighting system, totaling $60,000. The street-lighting system alone will cost about $40,000, and it is expected that this portion of the work will be placed under way at an early date. Charles Reeder, Park avenue and Saratoga street, Baltimore, is engineer.

Princeton, W. Va.—The Princeton Power Co. has filed notice of increase in its capital from $250,000 to $300,000.

Wilson, N. C.—Plans are under way by the city council for the installation of a street-lighting system, with improvements in light and power facilities, to cost about $100,000.

Augusta, Ga.—The city council is negotiating for a site for its proposed hydroelectric power plant. Lockwood, Greene & Co., Healey building, Atlanta, Ga., is the engineer for the project.

Camilla, Ga.—The city has granted a 20-year franchise to the Baker County Power Co., which will furnish electric current to the extent of 300 hp. Address R. L. Hall, president, Newton, Ga.

Gainesville, Fla.—The city will vote on the issuance of $30,000 in bonds for improving the water and light plants. Address the mayor.

Jacksonville, Fla.—Bids will be received shortly for an electric line to the plant of the Federal Ice Refrigerating Co. to be built in the Moncrief railroad yards.

Jacksonville, Fla.—Plans for the lighting of ten acres of land at the state fair grounds, to be set aside for a parking ground and camp site for winter tourists, will be taken up with the city commission by the camp site committee of the tourist division of the Chamber of Commerce. Address T. O. McBride, chairman.

Moore Haven, Fla.—The city has granted a franchise for operating a telephone system. Address the mayor.

Oldsmar, Fla.—The Oldsmar Electric & Ice Co. has perfected plans for the erection of an addition to its electric generating plant to cost about $250,000, including equipment.

NORTH CENTRAL STATES.

Holland, Mich. — Plans are under way to install boulevard lights on Eighth street from Central avenue to River avenue. Address J. J. Rutgers.

Owosso, Mich.—The city has rejected all bids for the installation of a boulevard lighting system, and will re-advertise.

Tecumseh, Mich. — The Hayden Milling Co. is about to harness the surplus water that flows over the dam at the Glove pond by erecting a power plant. An agreement has been signed with the Tecumseh Electric Co., whereby that concern will operate the plant and dispose of all surplus current over that needed to furnish light and power to the mill. The plant equipment will consist of a hydroelectric engine of 310 hp.

Union City, Mich.—The village council is laboring with the water power problem. Owing to the fact that the yearly cost of coal to run the municipal steam plant is gradually mounting to a prohibitive price, the village is anxious to secure available and practicable water power somewhere in the region along the St. Joe or Coldwater rivers.

Anderson, Ind. — A contract has been let to the Hatfield Electric Co., Maryland and Meridian Station, Indianapolis, for the construction of a $300,000 power plant for the city. Charles Brossman, architect, 1503 Merchants Bank Building, Indianapolis, has prepared plans. Address city clerk.

Newberg, Ind.—The Newberg Light & Water Co. plans to extend its wires and light to the Epworth coal mines.

Centralia, Ill.—City Engineer L. W. Lemon has prepared plans for city ornamental lighting system which is to be installed as soon as the legal machinery can be put in motion. The posts will be of concrete and will have a single light on each.

Quincy, Ill.—The Central Union Telephone Co. will add a half mile to its underground conduit system. Address Manager Halligan.

Appleton, Wis.—A. C. Eschweiler, architect, Goldsmith building, Milwaukee, has prepared plans for the erection of an addition to the telephone exchange of the Wisconsin Telephone Co.

Camp Douglas, Wis.—Henry C. Hengels, state architect, First Wisconsin National Bank building, Milwaukee, has prepared plans for a power house at the Wisconsin Military Reservation.

Manitowoc, Wis.—The city will install an ornamental lighting system.

Oconto, Wis.—The Northern Peshtigo Power Co. has been organized with a capital of $1,000,000 to erect a hydroelectric plant on the upper Peshtigo river in Wisconsin. A power plant site has been purchased at Cauldron Falls and will be improved up to about 25% of its estimated capacity of 10,000 hp. available at this point. Address T. A. Pamperin, secretary, Oconto.

Atwater, Minn.—A power and light company is being organized for installing an electric lighting system. Address Edward Feig.

Cloquet, Minn.—Bids will soon be received for a "white way" lighting system on Broadway and on Cloquet avenue from Broadway to Twelfth street. Address J. A. Parks, city clerk.

Currie, Minn.—A special election will be held soon to decide on building an electric light plant and extending the waterworks system. Address C. A. Portman, city clerk.

Duluth, Minn.—The city will extend its electric lighting system from Roosevelt to Cody street on Central avenue and from 54th to 59th street on Grand avenue. Address P. G. Phillips, commissioner.

Good Thunder, Minn. — The Citizens Telephone Co. will replace its telephone poles by laying cables.

Nelson, Minn.—The Nelson Light & Power Co. will build a line to Alexandria.

Fertile, Ia.—The city will install an electric lighting system. Address J. T. Tallackson, city clerk.

Tama, Ia.—Plans have been prepared by the Power Engineering Co., 621 Metropolitan Life building, Minneapolis, Minn., for a dam and canal work for a lighting system to be installed at an estimated cost of $40,000.

Kansas City, Mo.—The Kansas City Power & Light Co. will enlarge its plant by sinking a second condenser well and installing 20,000 or 30,000-kw. turbogenerator with auxiliaries. The estimated cost is $2,500,000. Plans to extend the transmission system next year at a cost of $2,000,000 are also contemplated. Address J. F. Porter, president.

Clay Center, Kan.—Bonds to the amount of $80,000 have been voted to improve and equip the municipal lighting plant.

McPherson, Kan.—Rudolph Goers, who will erect a flour mill here, de-

sires to equip it with electric power. If this is not possible attention must be given to the erection of a power house and the ordering of the necessary equipment.

Topeka, Kan.—An extension to cost $30,000 will be built to the electric plant of the Topeka Edison Co., 722 Van Buren street. It will house a new engine and generator. The plant already has a capacity of 5000 hp. The enlarged facilities will add 1500 hp. to the company's plant. Address A. H. Purdy, general manager.

Campbell, Neb.—A contract has been let to T. F. Blake, Broadwater, for an electric lighting plant. Henningson Engineering Co., engineer, National building, Omaha, has prepared plans. Address George E. Crilly, city clerk.

SOUTH CENTRAL STATES.

Grays, Ky.—The Grays Electric Light Co. has been incorporated with a capital of $3000, the incorporators being J. T. Gray and others.

Atkins, Ark.—The Atkins Light & Power Co. has increased its capital stock from $15,000 to $30,000.

Batesville, Ark. — The National Manganese & Ore Co., Indianapolis, Ind., is planning the erection of a hydroelectric power plant in this section to cost about $100,000. It will be used in connection with mining operations. H. A. Mansfield is vice-president and general manager.

Newport, Ark.—Fire on Sept. 20, originating in the power house of the Cotton Plant Veneer Co., destroyed that building, with other portions of the plant with a loss estimated at $35,000.

San Antonio, Tex.—Plans are being prepared for a five story fireproof addition to the Santa Rosa Infirmary. A complete bell and intercommunicating telephone system will be installed. All electric lighting fixtures will be of the indirect type. Address Atlee B. Ayres, who has prepared the plans.

WESTERN STATES.

Buffalo, Mont.—The city officials of Miles, Terry and Glendive will build a hydroelectric plant at Buffalo Rapids. Joseph C. Leighton, Miles City, is interested in the project.

Boise, Ida.—The Idaho Power Co. plans to erect a 132,000-volt line from its Thousand Spring plant to Caldwell.

Hoquiam, Wash.—Bids will be received for the installation of ornamental boulevard lights in the business section of the city. The estimated cost is $400,000. Address city commissioners.

Tacoma, Wash.—There is a possibility of an extension of the Pacific traction line from Murray to Camp Lewis. The proposition is now being investigated by the executive board of the retail merchants bureau of the Tacoma Commercial Club.

Yale, Wash.—The Northwestern Electric Co., Portland, Ore., plans to erect a hydroelectric plant here.

Eugene, Ore.—Bonds to the amount of $50,000 have been voted for a municipal light and power plant.

Portland, Ore.—The Federal Telegraph Co. has purchased a site for the erection of a large wireless telegraph station. A 620 ft. tower will be erected, together with a set of six smaller towers to hold six sets of antennae as well as buildings. The estimated cost is $200,000. Address F. R. Barstow, local manager.

The Dalles, Ore.—Property owners have agreed to install a "white way" system of lighting along Second street from the Hotel Dalles to the junction of the Dalles-California and the Columbia highways. The committee propose to install 72 lights at intervals of 75 ft., providing the city would agree to maintain the lights and accept them after they have been installed.

Bakersfield, Cal.—The San Joaquin Light & Power Corp. has asked permission to issue $2,000,000 in bonds for improvements. The necessity for this is new power houses and line extensions to take care of the natural growth of business that will be added to the company's lines during the coming year. Address A. G. Wishon, general manager.

Fresno, Cal.—The San Joaquin Light & Power Corp. plans to construct an electric plant on the Chowchilla road near Merced, Cal., at an estimated cost of $100,000.

Honcut, Cal.—The Irrigation Board is planning to construct irrigation reservoir system and canal in the Honcut-Yuba Irrigation District, the project to include gravity and pumping diversion at separate points. The estimated cost is $1,780,000. Address F. T. McCray, engineer.

Los Angeles, Cal.—The Southern California Edison Co. will build a power plant and extend its lines to furnish additional towns with light and power. Address R. H. Ballard, general manager.

San Francisco, Cal.—Application has been made by the Mount Shasta Power Co., operated by the Pacific Gas & Electric Co., to the State Railroad Commission for permission to issue bonds for $125,000,000, the proceeds from which are to be used for the construction of five generating plants on the Pitt river.

City of Mexico, Mexico.—Important improvements and possible extensions are to be made to the electrict street railway system of the Mexican Tramways Co., Ltd., in the capital and federal district. The company is also considering the carrying out of its plans for building interurban electric lines from the City of Mexico to Puebla, 130 miles, and to Toluca, 45 miles.

CANADA.

South Westminster, B. C.—Mundy, Rowland & Co., 510 Hastings street, has been awarded contract for supplying and installing electric motors, transformers, etc., costing $15,000, for Cut-To-Fit Buildings, Ltd.

Minnedosa, Man.—The Provincial Power Commission has been authorized to construct a power plant at a cost not to exceed $21,600 for the first year.

Fredericton, N. B. — The New Brunswick Hydroelectric Co. has decided not to proceed with any power development work on the North Shore at present, but will construct dams, power houses, etc., at Shogomoc, York county, and Musquash, St. John. Address Henry Holgate, consulting engineer, Montreal, Que.

Windsor, N. S.—Plans are being prepared for a power house, dam, pulp mill, etc., at an estimated cost of $250,000. Address T. B. Akins.

Newbury, Ont.—Construction of an electric light and power distribution system is planned by the city council at an estimated cost of $10,000. Address Charles Tucker, engineer.

Toronto, Ont.—Work has been started by the Ontario Hydroelectric Power Commission on the development of Raney's Falls, near Campbellford, Ont. The equipment to be installed consists of two 5000-hp. single-runner, vertical-draft turbines, operating at 47-ft. head at 120 r.p.m., direct-connected to the generators. It is expected that the plant will be in operation by 1922.

Cap de la Madeleine, Que.—Bids will be called for shortly for the installation of a fire alarm system for the city to be operated by electricity. The estimated cost is $8000. Address R. Morrissette, engineer.

St. John's, Que.—A general contract for constructing a steam power plant for Canadian Cottons, Ltd., 365 Aqueduct street, has been awarded to the Foundation Co., Ltd.

PROPOSALS.

Ashley, N. D.—Bids will be received Oct. 19 for an electric light plant. The equipment will consist of one 20 hp. oil or gasoline engine, one fuel tank in brick or concrete pit, one 12.5-kw. generator, 125 volts d-c. direct connected to engine, one 112.5 ampere-hour Edison storage battery and one switchboard. Plans have been prepared by Burchner & Orth, architects, 500 Shubert building, St. Paul, Minn.

New York, N. Y.—The Consul General of Costa Rica, 17 Battery place, is asking for bids for the construction and operation of an electric railway line, extending between two important communities with a distance of 22 kilometers. A 50-year franchise will be granted by the government of Costa Rica, and a number of important concessions made. No limit has been placed on the time for the bids.

INCORPORATIONS.

New York, N. Y.—The Segar-Suval Co. Capital, $15,000. To manufacture electrical specialties. Incorporators: T. Bodger, I. Siskind, and L. L. Segar, 515 West Eleventh street.

New York, N. Y.—S. O. S. Electric Sales Corp. Capital, $10,000. To manufacture electrical supplies. Incorporators: A. H. Baaren, H. V. Crawford and W. H. Peck, 120 Broadway.

Boston, Mass. — The Kamerite Products Corp. Capital, $50,000. To manufacture electrical specialties. Incorporators: A. Heath Onthank and H. Wray Rohrman, Arlington; and Stratford B. Allen, Cambridge.

Newark, N. J.—The Reliable Electric Co. Capital, $100,000. To manufacture electric lamps and other electrical products. Incorporators: William, Gus and Sam Gross.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

Offering of Philadelphia Electric Co. Preferred Stock.

The Philadelphia Electric Co. is offering through Drexel & Co., Brown Brothers & Co. and the National City Co. a new issue of $6,000,000 8% cumulative preferred stock at the par value of $25 per share and accrued dividend. The proceeds of this issue will be used to complete the Beach and Palmer streets generating station on the Delaware river in Philadelphia, and the necessary additional distribution facilities. It is expected that its initial capacity of 60,000 kw. will be available for the greatly increased demands on the company before next winter.

The following is a statement of earnings of the Philadelphia Electric Co. and its subsidiaries for the 12 months ending June 30, 1920:

Gross earnings	$18,101,032
Operating expenses, including current maintenance, rentals and taxes	11,626,334
Net earnings	6,474,698
Annual interest on funded debt, reserve for renewals and replacements and amortization of debt, discount and expense.	3,238,780
Balance applicable to dividends.	3,235,918
8% dividend on this issue of preferred stock had it been outstanding	480,000
Balance	2,755,918

New Issue of Commonwealth Edison Co.'s Stock.

Announcement has been made by the Commonwealth Edison Co., Chicago, of a new capital stock issue amounting to a little more than $5,000,000 par value, which is offered at par to the present stockholders, each having the right to subscribe for an amount equal to 10% of his present holdings. The company will purchase the rights of any stockholder who does not wish to exercise his subscription rights, so that it may offer this stock to its customers and employes. For subscription rights thus surrendered the stockholder will be paid at the rate of $2.50 a share of new stock. The right to subscribe for the new issue is open to stockholders of record Oct. 15. The proceeds are to be applied to reimbursement of the company's treasury on account of capital expenditures out of income.

Six Months' Showing of Habirshaw Electric Cable Co.

The Habirshaw Electric Cable Co., for the six months ending June 30, 1920, reports a surplus after charges of $421,748. After making deductions for estimated federal taxes and preferred dividends, the showing for the common stock amounted to $1.48 a share. Gross business for the current quarter is reported considerably in excess of the second quarter. The combined statement of the company and subsidiaries for the six months ended June 30, 1920, follows:

	June 30, quarter.	Six months.
Net sales	$3,406,921	$6,064,790
Profit and trading	410,357	593,902
Interest discount, amortization, etc.	89,536	172,154
*Surplus	$ 320,821	$ 421,748

*Before federal taxes and depreciation.

New Issue of Bell Telephone Co. Bonds Fully Subscribed.

An issue of $25,000,000 Bell Telephone Co. of Pennsylvania 25-year first and refunding mortgage 7% sinking fund gold bonds, series "A," dated Oct. 1, 1920, due Oct. 1, 1945, has been fully subscribed. The bonds were offered at 95% and interest, yielding about 7.45%. The proceeds will be used to fund current indebtedness incurred for construction purposes and to provide funds for construction through the years 1920-21. The bonds were issued under a mortgage to the Bankers Trust Co., trustee, covering as a first lien the entire physical property in Pennsylvania subject, as to a portion of the property, to the existing $9,543,000 Central District Telephone Co. first mortgage 5% bonds due in 1943.

Hurley Machine Co.

For the eight months ended Aug. 31 the company reports as follows:

	1920.	1919.
Net sales	$7,138,456	$3,163,006
Net profit after depreciation	1,108,241	580,159
Interest, discounts and other deductions—net	87,504	70,913
Preferred stock dividends	17,969	23,333
Net income	1,002,769	485,913
Common dividends paid	220,768	36,978
*Balance to surplus	782,000	448,935

*Before making provision for federal taxes.

Lake Shore Electric Co.

The following is the report of the Lake Shore Electric Co. for the period from Jan. 1 to June 30, 1920, with comparisons for the corresponding period in 1919:

	1920.	1919.
Gross earnings	$1,583,424	$1,190,196
Operating and taxes	1,212,967	898,932
Net	370,457	291,263
Interest	211,177	215,193
Surplus	159,279	76,070

Duquesne Light Co. and Subsidiaries.

The Duquesne Light Co. and subsidiaries for August showed an increase of $288,000 on gross earnings, with net after taxes $217,000, a decrease of $39,000. The net after taxes for the period from Jan. 1 to Aug. 31 amounted to $2,820,000, an increase of $13,000.

Bond Offering of Public Service Co. of Northern Illinois.

An issue of $1,000,000 Public Service Co. of Northern Illinois 8% collateral gold notes, due Sept. 1, 1930, is being offered by Halsey, Stuart & Co. and A. B. Leach & Co. at 100 and interest, yielding 8%.

Dividends.

The Public Service Corp. of New Jersey has declared its regular quarterly dividend of 1% on the common stock and 2% on the preferred, payable Sept. 30.

The New England Telephone & Telegraph Co. has declared its regular quarterly stock dividend of $2 a share, payable Sept. 30 to stock holders of record Sept. 22. The dividend rate of the company is thus increased from 7 to 8% per annum.

The Manchester Traction, Light & Power Co. has declared its regular quarterly stock dividend of 2%, payable Oct. 15 to stockholders of record Oct. 1.

The Kansas Gas & Electric Co. has declared its regular quarterly dividend of 1.75% on the preferred stock, payable Oct. 1 to stockholders of record Sept. 22.

The Carolina Power & Light Co. has declared its regular quarterly dividend of 1.75% on the preferred stock, payable Oct. 1 to stockholders of record Sept. 22.

The Western Electric Co. has declared its regular quarterly dividend of $2 on the common stock, payable Sept. 30 to stockholders of record Sept. 23.

The Asheville Power & Light Co. has declared its regular quarterly dividend of 1.75% on the preferred stock, payable Oct. 1 to stockholders of record Sept. 22.

The Yadkin River Power Co. has declared its regular quarterly dividend of 1.75% on the preferred stock, payable Oct. 1 to stockholders of record Sept. 22.

The Pacific Gas & Electric Co. has declared its regular quarterly dividend of $1.25 on the common stock, payable Oct. 15 to stockholders of record Sept. 30.

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery B'dg., Chicago.

	Div. rate. Per cent.	Bid Sept. 28.	Bid Oct. 5.
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	6	14	14
Adirondack Electric Power of Glens Falls, preferred	6	70	70
American Gas & Electric of New York, common	10+extra	91	91
American Gas & Electric of New York, preferred	6	36	36
American Light & Traction of New York, common	..	123	127
American Light & Traction of New York, preferred	6	82	82
American Power & Light of New York, common	4	45	45
American Power & Light of New York, preferred	6	68	68
American Public Utilities of Grand Rapids, common	..	6	6
American Public Utilities of Grand Rapids, preferred	7	14	14
American Telephone & Telegraph of New York	..	99	99
American Water Works & Elec. of New York, common	..	2½	2½
American Water Works & Elec. of New York, particip	7	4	4
American Water Works & Elec. of New York, 1st preferred	..	39	39
Appalachian Power, common	..	1	1
Appalachian Power, preferred	7	14	14
Cities Service of New York, common	+extra	296	296
Cities Service of New York, preferred	6	66	66
Commonwealth Edison of Chicago	8	100	100
Comm. Power, Railway & Light of Jackson, common	..	16	16
Comm. Power, Railway & Light of Jackson, preferred	6	36	36
Federal Light & Traction of New York, common	..	6	6
Federal Light & Traction of New York, preferred	..	41	41
Northern States Power of Chicago, common	..	30½	30½
Northern States Power of Chicago, preferred	ex.div.7	76	76
Pacific Gas & Electric of San Francisco ,common	..	48	48
Public Service of Northern Illinois, Chicago, common	7	64	64
Public Service of Northern Illinois, Chicago, preferred	6	84	84
Standard Gas & Electric of Chicago, common	..	13	14
Standard Gas & Electric of Chicago, preferred	8	35	35
Tennessee Railway, Light & Power of Chattanooga, common	..	1	1
Tennessee Railway, Light & Power of Chattanooga, preferred	6	2½	2½
Western Power of San Francisco, common	..	18	18
Western Union Telegraph of New York	extra	88	88
Industrials—			
Electric Storage Battery of Philadelphia, common	4	118	118
General Electric of Schenectady	8	140	140
Westinghouse Electric & Mfg. of Pittsburgh, common	7	49	49